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STATISTICS OF LAKE COMMERCE.

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LETTER

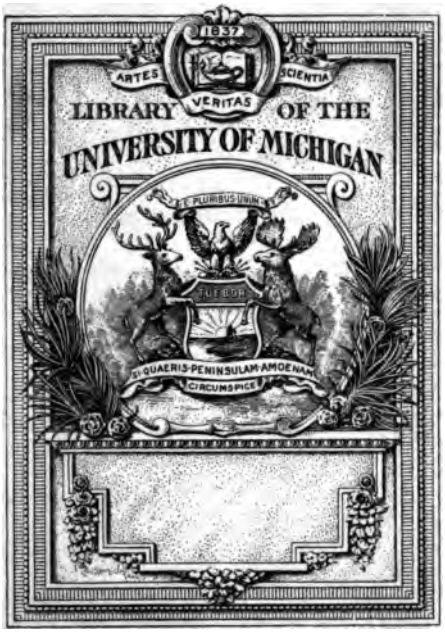
FROM

THE SECRETARY OF THE TREASURY

TRANSMITTING

A REPORT MADE TO THE BUREAU OF STATISTICS
BY MR. GEORGE S. TOWELL, OF CHICAGO,
ON LAKE COMMERCE.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1898.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STATISTICS OF LAKE COMMERCE.

LETTER

FROM

THE SECRETARY OF THE TREASURY,

TRANSMITTING

A REPORT MADE TO THE BUREAU OF STATISTICS
BY MR. GEORGE G. TUNELL, OF CHICAGO,
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55TH CONGRESS, 2d Session. } HOUSE OF REPRESENTATIVES. { DOCUMENT No. 277.

STATISTICS OF LAKE COMMERCE.

LETTER

FROM

THE SECRETARY OF THE TREASURY,

TRANSMITTING

A REPORT MADE TO THE BUREAU OF STATISTICS BY MR. GEORGE G. TUNELL, OF CHICAGO, ON LAKE COMMERCE.

FEBRUARY 3, 1898.—Referred to the Committee on Interstate and Foreign Commerce and ordered to be printed.

TREASURY DEPARTMENT,
OFFICE OF THE SECRETARY,
Washington, D. C., February 3, 1898.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES:

I have the honor to transmit a report made to the Bureau of Statistics, Treasury Department, on the commerce of the Great Lakes. This report was prepared by Mr. George G. Tunell, of Chicago, under the direction of the Bureau of Statistics, and embodies the first serious attempt to describe statistically this important branch of the domestic commerce of the United States. I can not too strongly urge the expediency of making this commerce a subject of annual record and investigation. The statistics of railway transportation have become a recognized branch of the Government statistical service; but the necessary complement, the movement of merchandise on lakes, rivers, and canals, has been neglected.

Compared with the shipping tonnage employed in the foreign commerce of the United States, the activity of the lake shipping is far greater. The bulk of transactions in the lake-carrying interests is so large as to rank it among the great conveyers of the world. The concentration upon a small number of commodities, as well as in a few companies, appears to make statistical records comparatively simple. On the important economic influences of this trade I need not dwell. They are of vital importance in feeding domestic industries and in permitting a further extension of American commercial interests in foreign markets. These influences are becoming stronger each year, and I believe the time has come when they should be made subject to official record, in order that they may be intelligently studied and directed so as to produce the highest benefits to the industrial and commercial interests of the United States.

Respectfully, yours,

L. J. GAGE, *Secretary.*

LAKE COMMERCE.

[Prepared under the direction of the Bureau of Statistics, Treasury Department, by George G. Tunell.]

TRANSPORTATION ON THE GREAT LAKES.

INTRODUCTION.

Many circumstances have recently directed attention to the transportation facilities of the Great Lakes. The rapid growth of lake traffic, the increasing size of lake vessels, the rapidity with which ships are loaded and unloaded, and other developments of a similar nature have interested the curious, while the vital significance of cheap carriage to the mining, farming, and lumbering interests, and to their numerous dependent industries, has compelled the people engaged in all these occupations to give careful consideration to the questions of lake shipping; and the whole subject of inland waterways has been forced upon the attention of men in public life by the appeals that have been made to Congress for large appropriations to immediately improve existing harbors and channels and for the speedy construction of a deep waterway from the Great Lakes to the sea. But, notwithstanding this widespread desire for information about the commerce on the lakes and its far-reaching importance to several of our great national industries, lake transportation has been well-nigh neglected, not only by writers on transportation, but by our Government as well; and this in the face of the fact that Congress is annually called upon to vote large sums of money to facilitate traffic upon these waters.

Not until the Eleventh Census was taken were full statistics gathered of the movement of commodities upon the whole lake system,[1] and since then (1889) nothing in the way of a comprehensive report has been made or even satisfactory data collected.[2] This being the situation, all hope of satisfactorily setting forth the development of lake commerce in all its aspects may as well at once be abandoned. In fact, the data are so meager and in part so unreliable that it is exceedingly difficult even to set forth the growth of the total movement on the lakes. As has already been stated, no statistics of the traffic moved on the whole lake system can be obtained previous to the year 1889.

[1] In 1852 a special report was submitted to Congress, entitled "Andrews' Report on Colonial and Lake Trade," but this report leaves much to be desired, and besides the period considered antedates that of this report. From this early date nothing comprehensive was attempted until the Tenth Census was taken, and even then only commodities carried in steam vessels were covered, and this portion of the subject was not fully treated. The bulk of this report was devoted to shipbuilding and to the fleets and but little space given to the commerce moved.

[2] See Appendix I for a critical examination of the data furnished by the Treasury and War Departments. Mr. C. H. Keep's report of 1891 will there be discussed.

For the later years we have nothing but the reports of the Chief of Engineers.[1] In the earlier years, however, the commerce passing through the Detroit River was very nearly equal to the total movement on the lakes, and thus pretty accurately reflected the development of commerce on the whole system, and it is therefore a cause for sincere regret that we do not possess full statistics of the traffic moved through this channel.[2] In recent years business between Lake Superior and Lake Michigan ports has largely increased, with the result that the commerce through the Detroit River is not now so good an index of the whole movement on the lakes as formerly. The growth of commerce on the Great Lakes, as reflected by the amount of traffic passing through the Detroit River, is disclosed by the following figures, which have for the most part been taken from the reports of Col. O. M. Poe, Corps of Engineers, U. S. A. The statement covers the traffic passing both up and down the river:

Commerce moved through the Detroit River. [a]

Year.	Registered tonnage.	Freight tonnage.	Year.	Registered tonnage.	Freight tonnage.
1873	.....	9,000,000	1889	19,646,000	19,717,860
1880	20,235,249	.....	1890	21,684,000	21,750,913
1881	17,572,240	.....	1891	22,160,000	23,209,619
1882	17,872,182	.....	1892	24,785,000	26,553,819
1883	17,695,174	.....	1893	.....	23,091,899
1884	18,045,949	.....	1894	26,120,000	24,263,868
1885	16,777,828	.....	1895	.....	25,845,679 or 29,000,000
1886	18,968,065	.....			
1887	18,864,250	.....	1896	.....	27,900,520
1888	19,099,060	.....			

[a] See Appendix I for the sources of these figures.

Assuming now that these figures are approximately correct and that they all vary to the same extent and in the same direction, we find that there has been a substantial increase in the traffic passing through the Detroit River. The traffic statistics show that there was a rapid increase from 1873 to 1880, but that during the decade ending with the year 1889 there was absolutely no growth. Inferences from these figures, however, should be drawn very cautiously. I am forced to believe that either the figures for 1873 or those for 1880 are incorrect. I am of the opinion that the remarkable development of traffic from 1873 to 1880 did not take place.

In discussing the points just raised I shall present what upon the whole must be regarded as the most satisfactory evidence we have of the growth of traffic upon the Great Lakes. It is the growth of the lake fleet. We have statistics of the tonnage of the lake fleet from the year 1868, and their accuracy can not be impugned.[3] On one side changes in the volume of traffic would be reflected slowly by the size of the fleet. If traffic decreased the fleet would not at once decline, for

[1] These reports are based on the data collected by the custom-house officials. No attempt is made to give the commerce for the whole lake system—simply the total number of clearances, with the total registered tonnage.

[2] This was true because there was very little local traffic on the lakes, and nearly the whole of the long-distance traffic passed through this channel. In 1889 the cargo tonnage carried through the river in American vessels was 19,717,860 tons, while the shipments from all American lake ports aggregated but 25,027,717 tons. (Eleventh Census, Transportation Business, Part II, pp. 275, 308.)

[3] That is, they are what they purport to be. All rigged craft, however, are classed with the sailing vessels, and consequently many vessels that are really barges are classed as sailing vessels. This is to be regretted.

the ships would be in existence and could not be put to other uses or removed from the lakes.

If, however, business fell off for a few years in succession, the tonnage of the fleet would surely be reduced. As the old ships became unseaworthy or as vessels were wrecked, new ones would not be built to take their places, and the tonnage would gradually decline, for people do not put money in a losing venture. An increase of traffic, unlike a decrease, is quickly reflected by accessions to the fleet. Years of heavy traffic are always prosperous years for the shipyards. It then appears that when the fleet is on the decline or stationary it may be inferred that there has been no growth of traffic, and that when the fleet is growing business is increasing.

In order to present the variations in the tonnage of the fleet in such a way that the changes and the whole movement can be easily and clearly apprehended, the figures have been charted.[1] The relative amounts of sail, steam, and barge tonnage must be noted, for on the lakes a steamer is supposed to be able to do two and one-fourth times the work of a sail vessel of like tonnage.[2] The barges make as good time as the steamers that tow them, so the carrying power of the barge tonnage is also much greater than a like amount of sail tonnage. The effective carrying power of all the vessels has been largely increased by the improved facilities that have been introduced for loading and unloading vessels.

From the chart just mentioned, which may be found on the page opposite, it appears that from 1868 to 1872 the lake fleet did not quite maintain its own, and then made rapid gains until 1875, when the total tonnage stood at 587,234 tons. From this high point the tonnage steadily declined until 1879, when it stood at 552,602 tons. The next year the tonnage increased to 557,942 tons and during the two following years jumped to 648,815 tons and then increased slowly until 1886, being but 690,359 tons in that year. At about this time the new era in lake transportation began; the long stupor that had come over the lake carriers was broken and lake transportation was transformed from an antiquated to a modern industry. Since 1886 the tonnage on the lakes has almost doubled, large accessions having been made every year, the years 1894 and 1895 excepted.[3] The growth of and changes in the tonnage have now been pointed out, but the extent to which these alterations enlarged the carrying capacity of the lake fleet still remains to be shown. As has already been stated, it is generally held that a steamer can do two and one-fourth times the work of a sailing vessel of like tonnage. It is obvious, then, that special importance attaches to the increase of this kind of tonnage, and by the introduction of more powerful engines the steamer itself became progressively a more efficient instrument.

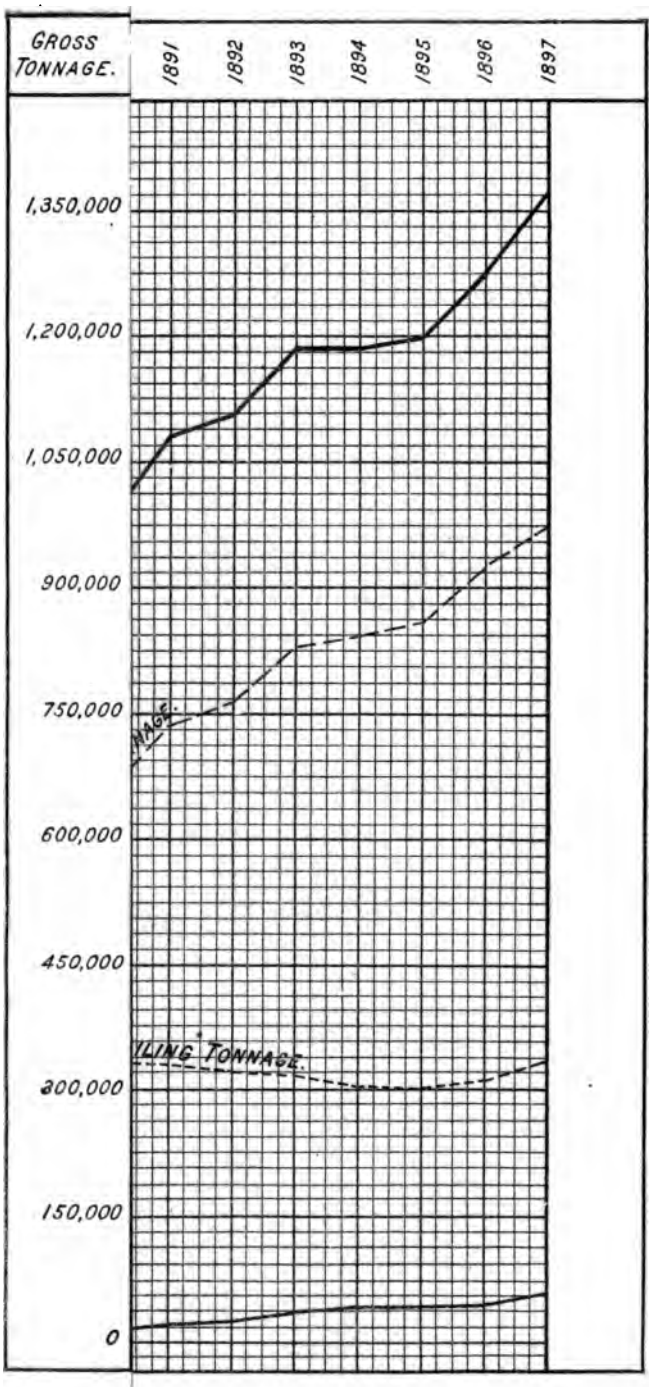
Improved facilities for fueling, unloading, and loading vessels have also very greatly increased the carrying power of the whole fleet, to say nothing of the enlarged carrying power due to better locks and the

---

[1] The figures may be found in Appendix I.

[2] On the ocean it is generally held that a steamer can do three times the work of a sailing vessel of like tonnage. The greater superiority of the steamer over the sailing vessel on the ocean is due to the fact that ocean voyages are generally longer than lake voyages, and it is while at sea that the steamer gains on the sailing vessel. The sailing vessel is unloaded just about as rapidly as the steamer.

[3] In examining the chart two facts should be kept in mind: (1) That the years given are the fiscal years, and therefore ended on the 30th of June of the calendar year; and (2) that vessels are built on contracts that frequently call for delivery at a distant day, and so building may continue for some time after a period of limited traffic has set in.


GROSS TONNAGE.
1891
1892
1893
1894
1895
1896
1897
1,350,000
1,200,000
1,050,000
900,000
750,000
600,000
450,000
300,000
150,000
0
AGE.
ILING TONNAGE.

4.

lighting of dangerous channels so as to permit passage by night. Mr. A. B. Wolvin informs me that fifteen years ago 15 or 16 round trips were considered a very good season's work in the ore business between Lake Superior and Lake Erie ports, whereas 22 round trips are now considered nothing more than a fair season's work. I shall now show how the substitution of steam for sails, and other improvements, have enlarged the carrying capacity of the lake fleet. In the following estimates I have assumed that all the improvements other than the substitution of steam for sails have increased the efficiency of the steam tonnage by 75 per cent.[1]

It must be conceded that the estimates are conservative. In the subjoined table account has been taken of the greater carrying power of steamers and other improvements.

Year.	Sail and barge, plus steam tonnage, multiplied by 3.	Year.	Sail and barge, plus steam tonnage, multiplied by 3.
1868	742, 286	1885	1, 351, 516
1870	721, 098	1889	2, 058, 278
1873	881, 311	1890	2, 301, 335
1875	991, 848	1895	2, 912, 855
1880	982, 032	1897	3, 326, 592

This table shows that the working power of the fleet was less in 1870 than it was in 1868, but that it increased rapidly from the former date to 1875, but actually decreased from 1875 to 1880 and increased rapidly from 1880 to 1885. From 1885 to 1890 the growth was phenomenal, the carrying power of the fleet being almost doubled in a period of five years. Since 1890 the capacity of the fleet has largely increased, in spite of several years of general business depression.

Now let us return to the statement of the traffic through the Detroit River. Can 9,000,000 tons for 1873, and 20,235,249 tons[2] for 1880, and 19,717,860 tons for 1889 be considered as approximately correct? The chart opposite page 4 shows that from 1873 to 1880 there was practically no increase in the floating equipment on the lakes, the tonnage in 1873 being 520,811 tons and in 1880 but 557,942 tons. By the table above it will be seen that the effective carrying power of the fleet was increased by but 100,000 tons, steam having been substituted only to a limited extent for sails. With an increase of but 37,131 in the gross tonnage afloat on the lakes, could more than twice the amount of traffic be moved in 1880 as was carried in 1873? Under certain circumstances this feat would be possible. If the season of 1873 was an unusually dull one and a large portion of the fleet was tied up for a part or the whole of the season it would be possible, with no large accessions of tonnage, to carry twice the amount of freight in another season. But all the facts we have show that the year 1873 was more than a fairly good season. Rates, while not so high as during the preceding season, were nevertheless well maintained; the traffic through the St. Marys Falls Canal was large, shipments of flour and grain from Chicago and Milwaukee were heavy, and the receipts of these commodities at Buffalo

[1] It seemed best to me to make the increase of steam tonnage the basis of the estimate, for the other improvements in a rough way went hand in hand with the increase of this tonnage.

[2] It is to be noted that it has been accepted that the freight tonnage for 1880 was at least equal to the registered tonnage passing through this channel. This assumption is generally conceded to be entirely safe.

were fully up to the average. Eighteen hundred and seventy-three was a panic year, to be sure; but business in general was good up to the time of the crash, which did not come until well along in the autumn. This, then, being the situation, it becomes difficult to understand how, if a fleet of 520,811 tons was kept busy in 1873 in moving 9,000,000 tons of freight one of 557,942 tons could have succeeded in moving over 20,000,000 tons in 1880.

A comparison of the statistics of the traffic through the Detroit River for the decade ending in 1889 and the growth of the lake fleet during the same interval seems to discredit the traffic statistics. In 1880 the registered tonnage passing through the river was 20,235,249 tons and the tonnage of the lake fleet was 557,942 gross tons.[1] During the succeeding ten years the registered tonnage never in any one year equaled this amount, and stood at 19,646,000 tons in 1889,[2] the year of largest traffic. The tonnage of the lake fleet, on the other hand, steadily increased from 557,942 gross tons in 1880 to 907,664 gross tons in 1889, and the effective carrying capacity grew from 982,032 tons to 2,058,278 tons, or much more than doubled. These diverse facts are difficult to harmonize. It can not be offered in explanation that only a small part of the traffic on the lakes found its way through the Detroit River in 1889, for the traffic of this river stood in about the same relation to the total traffic on the lakes in 1889 as it did in 1880. Some change had taken place, but it was not great. Since 1889 the Detroit River has been progressively a poorer indication of the total traffic on the lakes, but still stands to-day as a pretty good index.

What the growth of traffic upon the whole lake system has been since 1873 has now been shown in indirect ways. In conclusion, I shall present the scant facts we have showing directly the development of commerce upon the whole system. It has already been stated that it was not until the Eleventh Census was taken that the total volume of goods moved on all kinds of vessels was ascertained. The total amount of shipments from American lake ports for the last census year (1889) was 25,027,717 net tons. The registered tonnage that cleared from all the collection districts on the chain of lakes for the year 1893 was 34,571,208 tons;[3] for the year 1894 37,565,229 tons,[4] for the year 1895 44,295,861 tons,[5] and for the year 1896 53,265,572 tons.[6]

As a rule the cargo tonnage is in excess of the registered tonnage.[7] If it be assumed that the cargo tonnage was just equal to the registered tonnage, there was a gain in the five-year period under consideration in the goods movement on the whole lake system of 12,537,512 tons and for the seven-year period a gain of 28,237,855 tons, which represents a

[1] To make this grand total every registered ton on the lakes would have to pass through the Detroit River 36.2 times, or a little oftener than once a week, for a season of eight months.

[2] As given by the census, the freight tonnage for 1889 was 19,717,860 tons.

[3] Annual Report Chief of Engineers, 1894, p. 2378.

[4] Ibid., 1895, p. 3068.

[5] Ibid., 1896, pp. 2895, 2896. Figures for 1894 and 1895 do not include Canadian tonnage; the report for the year 1893 leaves the point in doubt.

[6] These figures were kindly furnished by Lieut. Col. G. J. Lydecker, the Government engineer in charge of the improvements of the Detroit River.

[7] In the case of the St. Marys Falls Canal the freight tonnage has been considerably in excess of the registered tonnage. Lieut. J. B. Cavanagh, in a report to Brig. Gen. William P. Craighill, Chief Engineer, says: "Since 1885 the freight tonnage has exceeded the registered tonnage on an average by about 8 per cent." (House Doc. No. 110, Fifty-fourth Congress, first session.) The figures covering the commerce of the Detroit River also show that the cargo tonnage usually exceeds the registered tonnage.

gain for the shorter period of a trifle more than 50 per cent and for the longer period of 112.8 per cent. In 1889 all the railroads in the United States carried 619,165,630 tons of goods, and in 1894 674,714,747 tons, and in 1896 773,868,716 tons.[1] There was thus in five years a gain of 55,549,117 tons, a trifle more than 9 per cent, and in seven years a gain of 154,703,086 tons, or 24.9 per cent. The comparison, therefore, is very favorable to the lakes.

As all the data have now been presented showing the growth of the total movement of commodities on the lakes, the development of traffic upon the great divisions of the lake system will be considered. Here again there is a great dearth of information, but the situation is not so bad as it was in the case just considered. The problem must, however, be approached in a roundabout way, for there are no data showing the growth of the total movement on any one of the chief divisions of the lake system. The traffic on the lower lakes (Lakes Erie and Ontario) is pretty accurately reflected by the movement of goods through the Detroit River. This is true, because, as has already been said, the local business on the lakes is comparatively insignificant. The movement through the Detroit River much more accurately indicates the total traffic on the lower lakes than the commerce through the river reflects the aggregate business of the whole lake system, and for the simple reason that the local business is less in a small part than on the whole system. In 1889 there was a total goods movement through the Detroit River in American vessels of 19,717,860 tons, while the total commerce of Lakes Erie and Ontario and the St. Lawrence River in American vessels was but 807,125 tons more, or 20,524,985 tons.[2] If, now, it be accepted that the growth of the traffic through the Detroit River may be regarded as a fair index of the development of commerce on the lower lakes, it is but necessary to refer to the table, on page 3, of the traffic passing through the river.

Just as the Detroit River furnished a statistical key to the traffic on the lower lakes, so the St. Marys Falls Canal supplies a key to the commerce of the Lake Superior division of the lake system. In fact, it affords a better one, for all of the traffic going to and coming from Lake Superior must pass through the St. Marys Falls Canal,[3] while the lower lakes have two outlets. There is also less local business on the Lake Superior division, and for this reason also the "Soo" is a better key than the Detroit River.[4] As the commerce on Lake Superior has attained large proportions, the "Soo" occupies a very important position from a statistical point of view, and, fortunately, there are very full statistics of the traffic moved through it from the date of its opening in 1855.[5]

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[1] Statistical Abstract, 1897, p. 335.

[2] This amount is obtained by dividing by 2 the difference between the traffic moved through the Detroit River and the sum of the receipts and shipments from all ports on Lakes Erie and Ontario and the St. Lawrence River. In this operation all commerce passing to or from the lower lakes through the Detroit River is regarded as long-distance traffic, and the remainder (local traffic) is divided by 2 because it appears twice—once as shipments and again as receipts. The result thus obtained is not to be regarded as absolutely correct, but it may be taken as a close approximation.

[3] This gateway is commonly known as the "Soo"—the abbreviation of the longer name of Sault Ste. Marie, adopted by the Jesuit pioneers of the seventeenth century.

[4] During the year 1889 the local traffic on Lake Superior amounted to 351,997 net tons. This amount was obtained by dividing by 2 the difference between the sum of the shipments and receipts of Lake Superior ports and the tonnage of the "Soo" canal.

[5] See comments on these statistics in Appendix I, part 1.

The following table, taken from a report of General Superintendent Wheeler,[1] shows the growth of traffic upon the Lake Superior division of the lake system:

Commerce of the St. Marys Falls Canal.

Year. *a*	Registered tonnage.	Freight tonnage. *b*	Year. *a*	Registered tonnage.	Freight tonnage. *b*
1855	106,296		1877	1,439,216	
1856	101,458		1878	1,667,136	
1857	180,820		1879	1,677,071	
1858	219,819		1880	1,734,890	
1859	352,642		1881	2,092,757	1,567,741
1860	403,657		1882	2,468,088	2,029,521
1861	276,639		1883	2,042,259	2,267,105
1862	359,612		1884	2,997,837	2,874,557
1863	507,434		1885	3,035,937	3,256,628
1864	571,438		1886	4,219,397	4,527,759
1865	409,062		1887	4,897,598	5,494,649
1866	458,530		1888	5,130,659	6,411,423
1867	556,899		1889	7,221,935	7,516,022
1868	432,563		1890	8,454,435	9,041,213
1869	524,885		1891	8,400,685	8,888,759
1870	690,826		1892	10,647,203	11,214,333
1871	752,101		1893	8,949,754	10,796,572
1872	914,735		1894	13,110,366	13,195,860
1873	1,204,446		1895	16,806,781	15,062,580
1874	1,070,857		1896	17,249,418	16,239,061
1875	1,259,534		1897	17,619,933	18,982,755
1876	1,541,676				

a The canal was not opened until June 18, 1855. The traffic through the Canadian Canal, which was opened to commerce September 9, 1895, is included in the above statement for 1895–97.
b No record was kept of the cargo tonnage until June, 1881.

The very rapid growth of the tonnage passing through the St. Marys Falls Canal is in striking contrast with the very slow increase of that passing through the Detroit River. The growth of the traffic through the former gateway has also been much more uniform than that through the latter. Since the year 1880 business through the St. Marys Falls Canal has increased with surprising rapidity. This has been due for the most part to the astonishing development of the iron mines of the Lake Superior region during the last fifteen years. In 1880 but 677,073 net tons of iron ore were moved out of Lake Superior. Since 1884 the business has grown rapidly, and during the season of 1895 shipments slightly exceeded 8,000,000 net tons and constituted a little more than one-half of the total movement of freight through the canal. In 1896 the large business of the previous year was not realized, but the movement of iron ore during the season of 1897 surpassed all records, and amounted to 10,633,715 net tons. Lumber, grain, flour, and coal are the other items which have made the largest contributions to the increased movement.

There still remains of the lake system one division to be considered; it is formed by Lakes Michigan, Huron, and St. Clair. The growth of commerce on this group can not be set forth, even approximately. The traffic through the Detroit River conveys some idea of the development of the business of this group, but not a very good one. This is the case because the local traffic upon Lake Michigan is too large to be ignored, and because there is now a large movement of iron ore and lumber from the ports of Lake Superior to those of Lake Michigan.

Several striking facts concerning the character of lake transportation are brought out by the traffic statistics. Probably the first to arrest attention is the celerity with which cargoes are loaded and

[1] Mr. Wheeler is the Government engineer in charge of the canal.

unloaded. Instead of losing days in receiving and discharging cargoes, as was once the case, only hours are now lost. Perhaps this statement is not strong enough, for if averages could be obtained it would probably be found that it does not now require so many hours to load and unload as it did days some years ago. Vessels lose almost no time at the docks. It is almost literally true that they are constantly going or coming; that is, they are nearly all the time engaged in the work for which they were designed, namely, carrying goods. This great dispatch is in a large measure gained by building vessels and docks adapted to each other. It must not, however, be understood that this development has reached its final phase, for in the handling of certain commodities much yet remains to be accomplished. As the iron ore business has become concentrated in a few hands, with the result that the ore is now conveyed from its natural bed in the mines to the furnace by the same party, it would be expected that here would be found the most harmonious and complete development of machinery for the cheap and expeditious handling of freight, and such is the case. The docks have been so constructed that ore may be spouted into all the hatches of the ship at the same time, and just recently a dock has been completed equipped with such a large number of hoists as to permit ore to be raised from all of the hatches simultaneously of even the largest vessels.[1] Much progress has also been made in the expeditious handling of other commodities, particularly coal.[2]

Another change which has materially reduced the time vessels lose in port is the new method of fueling. Instead of the vessel going to the docks to be coaled, at a great sacrifice of time, the fuel is now brought alongside the vessel on a scow or barge and put on board while the ship is being loaded or unloaded.

The importance of these two changes can not easily be overestimated. They largely account for the fact that while fifteen or sixteen round trips from the head of Lake Superior to the foot of Lake Erie were regarded as a good season's average fifteen years ago, nothing short of twenty-two would now be considered as satisfactory in the iron-ore traffic. Our interest does not center in the mechanical improvements that have made this greater number of trips possible. It lies rather in the influence the larger number of trips may have upon the cost of transportation and ultimately upon rates, and when these are taken up in detail the improvements that have increased by more than one-third the effective carrying power of vessels will again be considered.

Another striking fact of lake traffic is its extreme simplicity. It is in the main made up of but few commodities. The articles which constitute the great bulk—almost the whole—of the commerce moved are the crude products of the extractive industries. The mines, the forests, and the grain fields of the territory about the Great Lakes are the sources in which the mass of the traffic originates. During the last census year the three commodities—iron ore, lumber, and coal—contributed 75.73 per cent of the tonnage of the lakes, and grain and mill products contributed 16.15 of the remaining 24.27 per cent, thus leaving but 8.12 per cent undistributed.[3]

During the navigation season of 1896 there passed through the St.

[1] This dock is located at Conneaut, and is the property of the new mineral railroad, the Pittsburg, Bessemer and Lake Erie.

[2] Nothing more on this point will be said at this time, for as each of the leading commodities that go to make up lake commerce is studied the machinery used in moving it will be considered at length.

[3] Eleventh Census, Transportation Business, Part II, p. 308.

Marys Falls Canal 16,239,061 net tons of freight. To this amount iron ore, lumber, coal, grain, and flour contributed 15,432,993 tons.

In a very large measure the traffic of the Detroit River presents the same simplicity as that of the St. Marys Falls Canal. Several of the articles, however, which were rather insignificant among the commodities sent through the St. Marys Falls Canal attained some degree of importance among the items of freight passing through the Detroit River. During the navigation season of 1895 iron ore and finished iron, coal, grain and flour, and lumber (not including logs) contributed 23,104,239 tons to the 25,845,679 net tons of freight passing through the river. In order to more clearly set forth the simplicity of lake traffic a detailed statement of the commerce passing through these two channels will be inserted.

Statement of the freight traffic through the St. Marys Falls Canal for the season of 1896.a

Items.	Total traffic.	Items.	Total traffic.
Coal.....net tons..	3,023,340	Copper.....net tons..	116,872
Flour.....barrels..	8,882,858	Iron ore.....do....	7,909,250
Wheat.....bushels..	63,256,463	Lumber.....M feet, B. M..	684,986
Grain, excluding wheat.....do....	27,448,071	Silver ore, in bullion.....net tons..	240
Manufactured and pig iron.net tons..	121,872	Building stone.....do....	17,731
Salt.....barrels..	237,515	Unclassified freight.....do....	520,851

a The commerce passing through the Canadian Canal is included.

Commerce of the Detroit River during the season of 1895, comprising staples only, and only such staples as were shipped on vessels that cleared from United States ports.a

Commodity.	Amount.	Net tons.
Iron ore and finished iron		8,451,688
Copper ore		107,147
Coal		7,834,942
Silver ore		100
Building stone		347,000
Cement.....barrels..	711,078	106,677
Wheat.....bushels..	59,425,842	1,865,735
Flour.....barrels..	11,536,246	1,153,620
Corn.....bushels..	47,334,981	1,314,463
Rye, barley, and oats.....do....	39,116,202	844,791
Flax and grass seed.....do....	3,410,451	77,516
Salt.....barrels..	703,078	98,000
Shingles and laths.....pieces..	199,170,000	50,000
Telegraph poles.....do....	165,734	42,000
Logs.....feet, B. M..	95,000,000	152,500
Lumber.....do....	1,098,649,400	1,639,000
Provisions.....hogsheads..	609,000	130,500
Unclassified freight		1,630,000
Total		25,845,679

a Annual Report of the Chief of Engineers, 1896, Part V, pp. 2895–2896.

Another of the conspicuous features of lake transportation is the great preponderance of east-bound over west-bound tonnage. In 1890 the total east-bound traffic through the Detroit River in American vessels was 15,670,156 net tons, while the west-bound traffic was but 6,080,757 net tons.[1]

Although the excess of east-bound over west-bound is very large in the case of the Detroit River, it is still more characteristic of the traf-

[1] Internal Commerce of the United States, 1891, p. xxxix. This is the latest year for which we have official statistics which distinguish between east and west-bound traffic passing through the Detroit River.

fic passing through the St. Marys Falls Canal; moreover, present indications go to show that the equilibrium will be still further disturbed, for the east-bound movement through the canal has recently been increasing at a more rapid rate than the west-bound. For the navigation season of 1896, the east-bound commerce passing through the United States and Canadian canals at the Falls of St. Mary amounted to 12,737,062 net tons, while the west-bound tonnage was but 3,501,999 net tons,[1] or somewhat more than one-fourth of the east-bound.

The difference in volume between the east and west bound movements is not so great in the case of the business to and from Lake Michigan as it is in the case of the other lakes. The great disparity which exists between the east and west bound commerce on the lake system, as a whole, is largely due to the fact that as a nation we ship by all routes much more freight to the East than we receive from the East. Inequality of east and west bound shipments is not peculiar to lake transportation; it also characterizes railroad traffic. This disproportion is explained by the fact that in exchange for its heavy products of the mine, field, and forest, the West receives the manufactured products of the East and of foreign countries. The finished products received in exchange do not of course even remotely approach the crude products in weight and bulk.

Local traffic on the Great Lakes is comparatively insignificant. Nearly the whole of the commerce moved is carried from one end of the lake system to the other. About four-fifths of the iron ore mined in the Lake Superior region is transported to Lake Erie ports, and nearly the whole of the remaining fifth is taken to Milwaukee and Chicago. The shipments for the year 1896 amounted to 9,934,446 gross tons; of this amount 8,026,432 tons, or about four-fifths, were received at Lake Erie ports.[2]

Nearly all of the grain and flour moved on Lake Superior is shipped from Duluth, West Superior, and Ashland, at the extreme western end of the lake, to Buffalo, at the extreme eastern end of Lake Erie, or a distance of approximately 1,000 statute miles. And the bulk of the grain and flour and other mill products transported on Lake Michigan originates in Chicago and Milwaukee, at the southern end of the lake, and is transported to Buffalo, at the other end of the lake system. The total shipments of wheat, corn, and other grain in the last census year (1889) aggregated 3,401,881 tons, and of this amount 3,008,901 tons were shipped from the ports of lakes Michigan and Superior. The receipts at the ports of Lakes Erie and Ontario and the St. Lawrence River aggregated 2,902,378 tons. It must not be inferred, however, that the whole of the difference represents local traffic, for upon the whole lake system shipments exceeded receipts by 421,421 tons, and a large part of this excess found its way to Canadian ports on the lower lakes. The total shipments of mill products amounted to 894,123 tons, and of this amount 825,637 tons were shipped from the ports of Lakes Michigan and Superior. Receipts at the ports of lakes Erie and Ontario and the St. Lawrence aggregated 861,187 tons.[3]

Lumber, the one large item remaining of the east and south bound freight, is also, for the most part, long-distance freight, but its places

[1] These figures were kindly furnished by the officers in charge of the canal.

[2] See Appendix III for detailed statement of shipment and receipt of iron ore by ports for a series of years.

[3] It is to be noted that the receipts of mill products exceeded the shipments by 97,943 tons. There were some importations from Canada, but it seems hardly probable that they equaled this amount.

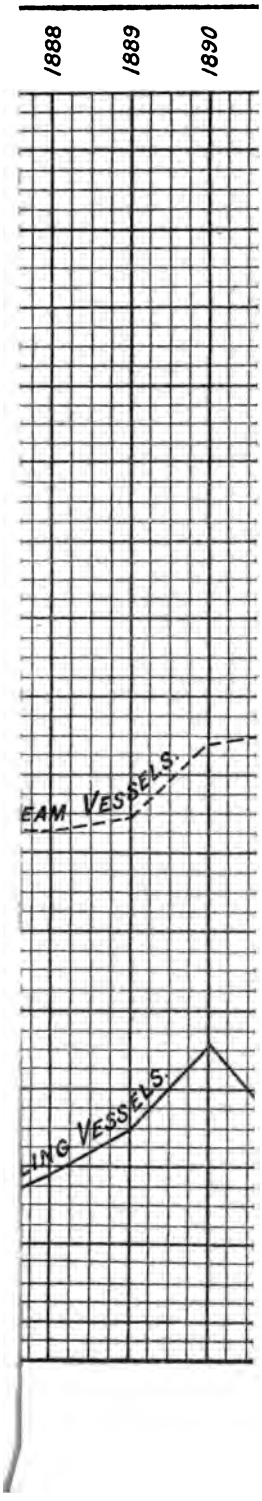
of origin and destination are so numerous that this fact can not easily be pointed out. The west-bound traffic consists almost entirely of the one article coal. It forms cargoes for vessels on return trips up the lakes, and as it is shipped from Lake Erie ports and in the main is carried to the ports at the far ends of lakes Michigan and Superior, it too is long-distance freight. In the last census year the total movement of coal and coke was 6,105,799 tons.[1]

The shipments from Lake Erie ports aggregated 5,196,182 tons, and the receipts at the ports of lakes Michigan and Superior were 4,619,696 tons. The total shipments on the lakes exceeded receipts by 943,328 tons, and probably the bulk of this excess represents exportations to Canada, some of which was carried well up the lakes. All the large items of lake commerce have now been considered, and it has been found that in general they may be regarded as long-distance freight. This is equally true of most of the smaller items and of the package freight. But limitations of space forbid a detailed examination of the various items. In conclusion, some general evidence of recent date will be submitted to show the preponderance of the through traffic. General Superintendent Wheeler reports that the average distance that the 16,239,061 tons of freight which passed through the St. Marys Canal in 1896 were carried was 836.4 miles. And in the brief recently prepared by Mr. C. H. Keep for the Lake Carriers' Association it is stated that the average length of haul for the 29,000,000 tons of freight that passed Detroit in 1895 was 750 miles.

Far-reaching changes in the instrumentalities employed in the movement of lake commerce have lately taken place. Not only has there been a very rapid increase in the size of the vessels, but there has also been a revolution in the materials used in their construction and in the motive power employed. In 1868 the average size of the sailing vessels on the lakes was 158 gross tons; in 1870 it was 156 tons; a decade later it had increased to 209 tons, and two decades later to 258 tons, while in 1897 the average tonnage of the sailing vessels was 336 gross tons. Steamers have increased in size even more rapidly. In 1868 their average gross tonnage was but 231 tons, and in 1870, 223 tons. During the next ten years it remained about stationary, being but 228 tons in 1880. The following decade, however, witnessed a very rapid increase, and the average admeasurement of the steamers that plied on the lakes in 1890 was 427 gross tons. There was still further progress during the succeeding seven years, and in 1897 the average gross tonnage of the lake steamers had reached 551 tons, or almost two and one-half times what it was in 1870.

Owing to the comparative absence from Lake Superior of small craft engaged in passenger and local freight business, the average size of the vessels in the heavy and long-distance freight traffic of the lakes is much more accurately indicated by averages covering the vessels employed in the commerce of this lake than by the figures that have just been presented. In 1870 the average registered tonnage of the various kinds of vessels passing through the St. Marys Falls Canal was approximately 375 tons; in 1880 it was about 495, and by 1890 it had increased to about 800 tons. In 1896 it had much more than doubled as compared with 1870, and was 926 tons registered. Figures showing the progressive increase of the average size of the vessels constituting the whole lake fleet have now been presented. These averages do not, however, convey an adequate idea of the change which has taken place, and for the obvious reason that because the life of a ship extends over a con-

[1] Coke is a very small item.


1888
1889
1890
EAM VESSELS
LING VESSELS

siderable period of time, the small vessels constructed in the earlier periods are still in existence to depress the averages of the later periods. To eliminate this source of error, statistics will be given showing the average size of the new construction year by year.[1] In order to show clearly the trend, these statistics are presented in the form of a chart, which appears on the opposite page.

The chart clearly shows that the average tonnage of the sailing vessels has not greatly increased, and the average tonnage of the steamers shows no remarkable change up to the fiscal year 1887. From 1887, however, the average tonnage increased by leaps and bounds. The average gross tonnage of the steamers built in 1886 was but 269.10 tons, while in 1891 it was 758.72 tons, and in 1897 1,436.91 tons. This is equivalent to an increase in size of 534 per cent in the twelve-year period under consideration. To enable one to form an accurate conception of the size and carrying capacity of the propellers now being constructed, I shall give the dimensions of a steamer now being built for the Bessemer Steamship Company by F. W. Wheeler & Co. This vessel is larger than any vessel afloat on the lakes or any other vessel now building. She will measure 475 feet over all, and will have a beam measurement of 50 feet and a depth of 29 feet. Her carrying capacity will be between 6,500 and 6,750 gross tons on a mean draft of 17 feet.[2]

These dimensions and capacity will probably very soon be exceeded, for the tendency seems to be toward still larger vessels. To give the reader some idea of the relative size of lake and ocean vessels, I shall compare the dimensions of the largest vessel about the lakes with those of two of the largest ocean vessels—*Kaiser Wilhelm der Grosse*, which is the largest steamer now in service, and the *Oceanic*, now building—the largest steamer either in service or building.

Dimensions. *a*	Bessemer steamer.	Kaiser Wilhelm der Grosse.	Oceanic.
	Feet.	*Feet.*	*Feet.*
Length over all	475	648	704
Length of keel	455	.....	685
Beam	50	66	68
Depth	29	43	46

a The dimensions of these ships were furnished by Mr. L. M. Bowers, general manager of the Bessemer Steamship Company; Oelrichs & Co., New York agents of North German Lloyd, and the New York agents of the White Star Line.

It appears by this table that the *Oceanic*, the largest ocean vessel, surpasses the largest lake vessel in the matter of length by 48 per cent, in breadth of beam by 36 per cent, and in depth by 58 per cent. The great disparity in the matter of depth is explained by the shallowness of the water in the harbors and channels which connect the lakes.

Another conspicuous feature of the history of the lake fleet is the rapid substitution of steam for sails as a motive power. In 1868 there were in the waters of the Great Lakes 624 steam vessels, with a measurement of 144,117 gross tons, and 1,855 sailing vessels, with a measurement of 293,978 gross tons. The sailing tonnage was thus a trifle more than double that of the steam tonnage. The relative importance of these two classes of vessels changed very slowly during the next fifteen years, and it was not until 1884 that the steam exceeded the sail ton-

[1] These statistics may be found in Appendix 1.

[2] These facts were kindly furnished to me by Mr. L. M. Bowers, general manager of the Bessemer Steamship Company.

nage. Since 1884 the sailing tonnage, as it appears on the records of the Bureau of Navigation, has remained about stationary, being 307,733 gross tons in that year and 334,104 gross tons in 1897. The steam tonnage, on the other hand, has increased with great rapidity since 1884, and is now nearly three times as great as the sail tonnage. In reality, however, the sailing tonnage is very much less now than it was in 1884. Many of the vessels classed as sailing vessels have really been transformed into barges, for they are now habitually towed. These vessels are difficult to classify, as they have not been dismantled. If their rigging were taken down, they would be classified with the barges. The law requires the Commissioner of Navigation to document and report vessels by their rig. Whether canvas is occasionally or never stretched is a matter into which he can not officially enter. "The rig's the thing." The acts of Congress assume that where a vessel has motive power of its own it uses it, though it is generally known that towing is resorted to, and to a very great extent.

The tonnage of sailing vessels on the records of the Bureau of Navigation also includes a number of vessels almost always spoken of on the lakes as barges. These vessels form a very respectable tonnage, as most of the new steel barges fall within this group. These barges are officially classified as sailing vessels, for the same reason that many of the vessels that were once sailing vessels, but are now barges, are still officially grouped with the sailing vessels—namely, for the reason that they are rigged. Most of the new steel barges can spread a limited amount of canvas, but they are habitually towed, and only raise their canvas when a favorable wind blows. The statistics without explanation, therefore, convey but a very imperfect idea of the extent to which business is now being done by sailing vessels. Sailing vessels, in the true sense, have practically disappeared from Lake Superior. When at St. Marys Falls Canal, I was informed, on the 9th of September, by Mr. Andrew Jackson, one of the officers in charge of the canal, that but six sailing vessels running independently had been passed through the locks during the season of 1897.[1] Mr. A. B. Wolvin, a vessel owner and one of the largest shippers on the lakes, told me about the middle of September that he had seen but one sailing vessel on Lake Superior running independently in six years.[2] Sailing vessels have also largely disappeared from the lower lakes. More of them remain on Lake Michigan than on any other lake. They are largely engaged in transporting lumber, ties, and posts, and do not often traverse the narrow channels connecting the different lakes through which it would be necessary to be towed. With the disappearance of sailing vessels, the large fleets of tugs stationed at the St. Marys, St. Clair, and Detroit rivers have lost a once profitable employment, and have now practically disappeared.

Perhaps the best evidence we have of the favor in which sail and steam vessels are now held are the statistics of construction for the last two years. The reports of the Commissioner of Navigation show that the steam tonnage constructed on the northern lakes during the last two fiscal years was almost eleven times that of the sail tonnage—the

[1] This may surprise one familiar with the annual reports of the commerce passing through the St. Marys Falls Canal. For instance, the latest report gives the number of sailing vessels passed through the locks in 1896 as 4,391. It seems strange that so few should use the locks in 1897. The situation is made clear by an explanation of the classification adopted in the report. In the canal report, all vessels not propelled by steam power, such as schooners, barges, and consorts of all kinds, and *which* are registered by the United States, are classed as "sailing vessels."

[2] *It needs hardly to be said* that pleasure boats are not included in this discussion.

former being 137,530.80 tons and the latter 12,661.11 tons. The sailing tonnage, as here given, does not include the steel sailing vessels, all of which, I am informed by Mr. W. I. Babcock, manager of the Chicago Ship Building Company, are really barges.

Steam is relied upon as a motive power to even a greater extent than the statistics which have been given would indicate. The barges are towed by the steamers, and so the barge tonnage is moved by steam power. The barge tonnage on June 30, 1897, as reported by the Commissioner of Navigation, was 60,783 tons. This statement does not include any of the sailing vessels that are always towed but have not been dismantled. Nor does this statement include any of the rigged barges of new construction that now form a respectable tonnage; in the single year 1897 there was a gross tonnage of rigged steel barges constructed of 34,630.37 tons. The statistics of construction and of the lake fleet are likely to be progressively misleading if continued according to the classification which now obtains, for transportation by tow barges seems to be gaining in favor. This is in part due to the fact that the dock facilities have been so enlarged that the steamer and her consort or consorts may be unloading at the same time. Formerly, as a general thing, the boats could only be unloaded in detail, and the steamer lost valuable time in waiting for the barges.

Circumstances decidedly favor the substitution of steam for sails. Steamers are operated on the Great Lakes under conditions the most favorable for steam navigation. Good steaming coal can be bought in the ports of the lakes at a very low price, and the voyages are very short in comparison with the long ocean voyage, a fact which makes it unnecessary to carry a great amount of dead freight in the form of coal. The comparatively limited extent of the lakes is favorable to steam navigation for still another reason. In severe storms sailing vessels are helpless and drift with the wind. On the ocean this is not dangerous, because there is sea room, but on the lakes vessels are soon driven ashore and wrecked. This danger is not so great in the case of steamers, for they can run against the wind and usually succeed in standing off from the shore.[1] These facts, together with the general desire of the modern business world for dispatch, sufficiently explain the change from sails to steam.

The increased size of ships and the substitution of steam for sails—two of the three radical changes we have to consider—have rendered desirable, in order to secure strength with lightness and elasticity, the third change, namely, the substitution of steel for wood as the material for construction. In lake vessels the machinery is placed far aft, and as the vibration is in most cases very much increased by the machinery being in this position, the hull must be made unusually strong. The hulls of lake vessels are also subjected to unusual strains, because of the machinery being placed far aft, when the boats are running light—that is, without cargo, the explanation being that the weight of the machinery and coal sinks the stern, and in rough weather the forward end of the ship is thrown very much out of water, producing a heavy "hogging" strain. This has been materially lessened in more modern vessels by increasing the depth of the water bottom, and thus the amount of water carried when light, but is at times very much aggravated by the practice of admitting free water into the cargo holds aft in order to get the wheel well down into the water so it will work effectively.

[1] During the navigation season of 1896, of the 14 vessels which were stranded and were a total loss, only 2 were steamers; the others were schooners. (The Marine Review, Vol. XIV, No. 24, p. 7.)

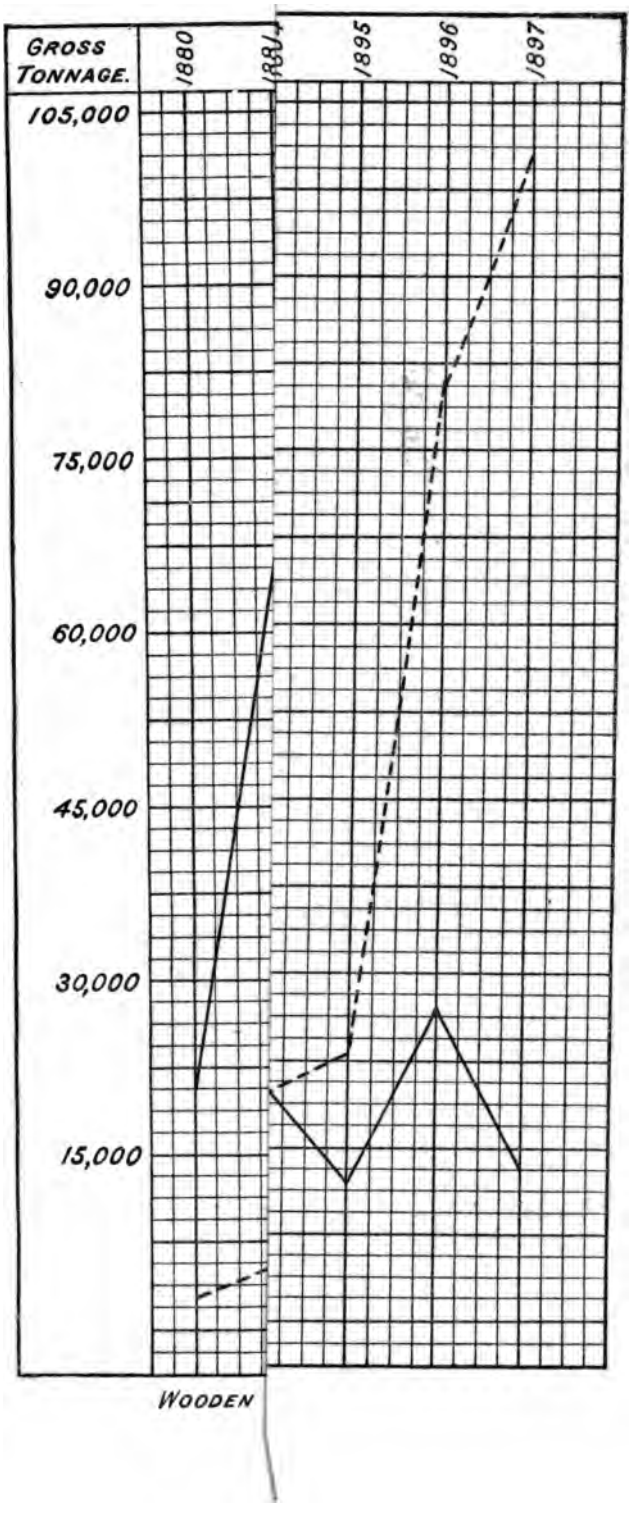
With the vessel loaded the strains are less with the usual arrangement of lake machinery than if it were amidships. A ship constructed of iron or of steel is much more buoyant than one built of wood. It is usually estimated that there is a difference in buoyancy of 30 per cent in favor of the iron and 45 per cent in favor of the steel hull. Steel is much more elastic than iron, and therefore bears strains much better.

As a result of this superiority in respect of strength, elasticity, buoyancy, and durability, the preference for steel has become very decided and as the price of steel has fallen very rapidly and that of wood has risen, it has become profitable to substitute steel for wood. There is probably in the world to-day no place at tide water where ship plates can be laid down for a less price than they can be manufactured or purchased at the lake ports. There is, therefore, every reason for steel being substituted for wood. In 1886 there were but six steel vessels, with an aggregate net tonnage of 6,459 tons afloat in the lake; since 1886 there has been a revolution in the material of the floating equipment. On June 30, 1897, the gross tonnage of steel vessels on the lakes aggregated 486,291.47 tons,[1] or much more than one-half that of the wooden tonnage, the latter being 885,832.85 tons. Steel was the material used in the construction of about eight-ninths of the tonnage built and documented in the fiscal year 1897. The chart on the opposite page shows the wood and metal tonnage by years since 1880.

Because of the more effective organization and use of labor and material forces and the use of improved facilities for handling freight at terminals, but especially on account of the betterment of the permanent way, and because of the introduction of more efficient instruments of transportation, our railroads have found it possible to lower their freight tariffs. From a later day similar changes have been in progress in the lake transportation business, and there also have made possible a reduction of charges. Better roadbeds, heavier rails, straighter tracks, with easier grades, find their counterpart on the lakes in deeper and more direct channels, and in more effective locks; the improvements which the railroad have introduced for the expeditious handling of freight at terminals have been more than equaled by the dock and steamship companies, and the rapidity with which cargo freight is now loaded and unloaded approaches the marvelous. Better tracks have made it possible to run heavier trains, and similarly, deeper channels have enabled the vesselmen to increase the burden of their ships. We have now seen that the improvements which have rendered possible a reduction of carrying charges on the railroad, have also made practicable a reduction of tariff on the lakes.

I shall now endeavor to show to what extent rates have fallen. First, let us compare the rates prevailing in one period with those of other periods to determine the absolute decline. In attempting to do this we are at the outset confronted with a serious problem, namely, the period to be selected as a starting point, and what other periods shall be contrasted with the one first selected. This matter is always a perplexing one, but in the case in hand it is unusually difficult, because of the violent fluctuations that characterize lake rates. To avoid some of the evils of an injudicious starting point, and also the more clearly to portray the movement, I have charted the charges for a long period. The article selected is wheat, and the rates are those between Chicago and Buffalo, as given by the New York Produce Exchange. The charges

[1] These figures include the iron vessels, which have a gross tonnage of about 30,000 tons.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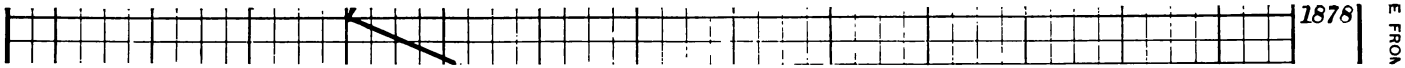
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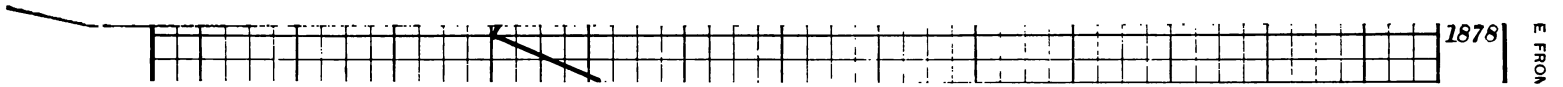
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for this commodity alone were charted, because wheat is a representative freight, and fairly reflects the general movement of rates.[1]

The chart shows that the trend has been very decidedly downward. I shall not attempt to describe more minutely the downward movement, because it is quite impossible to select representative years, and the chart presents the matter very clearly and forcibly. The first feature to arrest attention is the exceedingly violent fluctuation of the lake rates. The very erratic movement of the rates is explained by the method of fixing rates adopted by the lake carriers, who introduce an entirely new schedule at the opening of each season of navigation and alter it many times during the season. When business is heavy the rates go up, and when business is light the rates go down.

The following table shows the fluctuations of a single season:

Current weekly freights, per bushel, on wheat from Chicago to Buffalo by lake during the season of 1895.

[Report of Chicago Board of Trade, 1895, p. 113.]

Week ending—	Cents.	Week ending—	Cents.	Week ending—	Cents.
Apr. 13	1⅜	July 6	1	Sept. 28	2¼
20	1⅜	13	1	Oct. 5	2½
27	1⅜	20	1	12	3
May 4	1¼	27	1¼	19	4½
11	1¼	Aug. 3	1¼	26	3
18	1⅛	10	1⅛	Nov. 2	3
25	1¼	17	1⅛	9	3
June 1	1⅜	24	1⅛	16	3
8	1¼	31	1⅛	23	2¼
15	1	Sept. 7	1⅛	30	2¼
22	1	14	2	Dec. 7	2¼
29	1	21	2¼	14	2¼

These violent fluctuations serve to show the flexibility of the lake charges, the readiness with which the rates are adjusted to what the traffic will bear, and stand in striking contrast with rail rates, which respond but slowly.

As a general thing, the discussions of lake rates are misleading. Rates have sometimes been so selected as to give one the impression that charges have fallen very rapidly and continuously. The following is an example in point: "In 1857 the average rate by lake and canal on a bushel of wheat from Chicago to New York was 25.29 cents; in 1870 the rate for the same service was 17.1 cents per bushel; in 1880 it was 12.27 cents per bushel, and in 1890 5.85 cents per bushel." Now note what a change is introduced by selecting the rates prevailing in 1858 instead of 1857, and in 1871 instead of 1870:

Year.	Rates.	Year.	Rates.
	Cents.		*Cents.*
1857	25.29	1858	16.28
1870	17.10	1871	20.24
1880	12.27	1880	12.27
1890	5.85	1890	5.85

These examples show how important it is, if it be desired to communicate a correct impression of the movement of rates, that the greatest circumspection be exercised in the selection of the points of the move-

[1] These rates and those for several other commodities may be found in the appendices.

ment that are to be compared, and particularly in the choice of the initial point.

Another method of presenting lake freights in a very favorable light is by contrasting them with rail rates, which is usually done in the following manner: The average charge on all the railroads in the United States for hauling 1 ton 1 mile for some year is compared with the average amount exacted for a similar service on the lakes. Obviously this sort of procedure is unfair to the railways, for the service they perform differs from that rendered by the lake carriers. The railroad tonnage is largely made up of local freight, while the freight tonnage of the lakes is through traffic, and is composed of but few commodities, all of which are handled in large quantities. This characteristic of lake commerce is of the greatest moment, for it makes specialization in the shipping business possible, and assures a full cargo of one article at one port. It is needless to say that rates on the lakes would not be so low as they are if it were necessary to so construct vessels as to enable them to carry a variety of commodities, and if they were compelled to go to a number of ports to collect the cargoes; and then, too, it is to be remembered that the lake hauls are usually very long ones—a fact that has a most important bearing on rates.

Another way of showing the relative cost to the public of lake and rail service, that is often resorted to, is the comparison of lake and rail rates on some commodity which is transported in large quantities, and for long distances, by both carriers. Wheat and corn are such commodities. Have we here proper conditions for comparison? Clearly the circumstances are much nearer what they should be than they were in the case of the comparison of ton-mile charges; but even in this instance the conditions are not exactly fair. Allowance should be made for the fact that the National Government not only provides the lake carriers with channels and harbors free of charge, but also maintains them in good condition without compensation. In addition, there are minor factors that favorably affect the cost of the service rendered by the lake carriers, such as the liberality displayed toward the shipping interest by some of our State legislatures in the matter of taxation,[1] and the fact that the railroads continue their service during the winter, when the cost of service is manifestly much greater than during the summer. Thus it must be granted that even in the case of comparison of the lake and rail rates for some commodity which is transported in large quantities and for long distances by both carriers, we have not found a fair basis upon which the freight charges of the two transportation agencies can be contrasted, because the community as a whole comes to the assistance of the lake carriers, and because the service is rendered by one of the carriers at all times and by the other only at certain seasons when conditions are favorable.

As far as possible the statistical matter has been arranged in the appendices to correspond with the main divisions of the text—for example, in Appendix I will be found the tables that should accompany the introductory part of the report. Freight rates for any commodity may be found in the appendix corresponding in number to the part of the text in which the particular commodity is treated.

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[1]Minnesota is a good example. By an act recently passed, its shipping on the Great Lakes is practically exempt from taxation. Vessels pay a State tax of but 3 cents per net ton, and are entirely exempt from municipal taxation. (Report of Commissioner of Navigation, 1895, p. 202.)

APPENDIX I.

A VALUATION OF THE DATA FURNISHED BY THE TREASURY AND WAR DEPARTMENTS.

The data collected by the Treasury Department fall under three heads, (1) that concerning the fleets; (2) that concerning the foreign commerce; (3) that having to do with the coastwise trade. But little fault can be found with the facts concerning the fleet collected under the supervision of the Commissioner of Navigation. The accuracy of the facts he publishes can not be questioned, but they might in one important particular give more information than they do; in many cases it is impossible to ascertain the motive power employed. Vessels on the lakes are now classed as sailing vessels, steamers, barges, and canal boats. All rigged craft are grouped together as sailing vessels. As a result of this classification most of the vessels commonly known as barges are called sailing vessels, although they are regularly towed, and simply because they are rigged to carry a limited amount of canvas. Two sources of error result from this grouping: (1) Wind is made a more important motive power than it really is, and (2) the new sailing vessels are made to appear very large, while in fact they are generally very small vessels. Perhaps these sources of error could be eliminated by introducing a new group to be known as schooner barges. To do this, the statutes would first have to be altered.

Most of the vessels of the old schooner fleet are now regularly towed, but as they are still rigged they are classed with the sailing vessels, with the result that wind, according to the statistics, still appears to be relied upon to a very large extent as a propelling force. This source of error can not apparently be removed from the classification, for most of these vessels are in a position to run independently at any moment. As these vessels are not replaced by similar vessels as they become too old for service, or are wrecked, errors due to their existence will gradually disappear. The statistics of our foreign trade carried on over the lakes leave little, if anything, to be desired. The laws seem to be sufficiently stringent, and they appear to be rigidly enforced. Our foreign commerce over the lakes, however, is comparatively small, so these wise regulations only cover a small portion of the lake traffic. For several reasons the custom-house records of the coastwise commerce of the lakes are unreliable.

First of all, the laws governing the filing of manifests are not what they should be. They are faulty in three respects, and these were pointed out by Mr. C. H. Keep, in his report of 1891 on "The Commerce and Shipping of the Great Lakes." They are as follows: Under existing laws vessels carrying goods from a port in one collection district to another port in the same district are not required to report or clear at the custom-houses, and there is, therefore, no record in the custom-houses of the commodities so carried. But as the local business on the lakes is very small, this does not seriously impair the accuracy of the records. Second, there are a number of small ports on the lakes where there are no custom-houses, but at which a large lake business is done. Third, under the regulations that now obtain, a ship may clear from a port on the lakes for another port, and may stop at one or more intermediate ports, where she may receive and discharge cargo without reporting at the custom-houses of the intermediate ports.

The records of the custom-houses at the intermediate ports will show only the business done at such ports by vessels which make them

their original port of departure or ultimate port of destination. To the extent to which the ports are intermediate ports, the records of the custom-house will fall short of the business transacted at these ports. Errors due to this cause seriously affect the value of the records, and will probably do so to an increasing extent, for the traffic of the intermediate ports seems to be growing. The inaccuracies resulting from these three sources of error seriously impair the value of the records of the coastwise commerce of the Great Lakes. There are, however, still other sources of error, and in comparison with which those just enumerated are unimportant. The requirements of the law are not always scrupulously fulfilled. The manifests covering cargoes that are filed in the custom-houses in compliance with the law do not always give the cargoes correctly.

Inaccuracies are due to the following causes: (1) Masters are permitted, under certain circumstances, to clear at the same time they enter—this custom is productive of error because masters may not, for a variety of reasons, take aboard what they supposed they would when they cleared; (2) masters do not often know what they have on board when they clear, even after their vessels are loaded—in some cases the statements on the basis of which freight is collected are made up after the ship has left port, and forwarded to the captain by mail or telegraph, and in numerous instances captains never know what they have on board, as they are simply directed to go to a certain place and load (the manager of the dock being informed how much to put on), and then ordered to depart for a certain port, where the manager of the dock assumes all responsibility for records; (3) in the case of miscellaneous cargoes, it would be necessary to delay the departure of the boats in some cases in order to give a correct statement of the cargoes, so the manifests are likely to be the captains' estimates of what they have on board, and (4) some errors are due to indifference—in the minds of some captains the filing of a manifest is a mere form, for statistics, in their opinion, have no value.

Any attempt to remedy these evils should take cognizance of the fact that vast sums of money have been expended in terminal facilities, in order to secure dispatch in loading and unloading, and, therefore, regulations that would detain vessels would undo that which has been gained at an enormous expenditure of money and energy. If captains are forced to file correct statements of cargoes, vessels would in many cases be detained for some hours, and captains put to great inconvenience and to considerable expense. The docks are usually scattered over an enormous extent of territory. If a vessel finishes loading at 1 o'clock at night, the captain may be forced to walk several miles to the custom-house, as the street cars have probably stopped running, or secure a carriage at no little inconvenience and expense. Perhaps accurate statistics could be obtained and greater dispatch given to vessels by making the shippers instead of the captains responsible for reports.

Before leaving the data furnished by the Treasury Department a word must be said about the report on "The Commerce and Shipping on the Great Lakes," made by Mr. C. H. Keep, secretary of the Lake Carriers' Association, and which formed a part of the "Report on the Internal Commerce of the United States for the year 1891." Mr. Keep, wherever possible, went back of the returns of the custom-houses, and so in a measure eliminated the errors of these returns. Especial value, therefore, attaches to his statements.

The facts furnished by the Department of War fall under two heads,

(1) those based upon the custom-house records, and (2) those collected independently. For the most part the statistics published by the War Department are based upon the custom-house returns, and no attempt is made to eliminate the errors of these returns. The statements of traffic through the Detroit River and of the business transacted at the lake ports are always, I believe, based upon the records of the custom-houses, and are therefore subject to all the criticisms that have just been passed upon these records. The statements of the traffic through the St. Marys Falls are based upon data collected at the canal by the officers in charge. These statements should, therefore, accurately reflect the commerce passing through this gateway. Unfortunately, however, they do not, and this in spite of the fact that great care is taken by the officers in charge of the canal to secure accurate information. The efforts of the officers are balked because of the failure of the lake carriers to cooperate with them. As has already been stated, in many cases masters do not know what they have on board, and can not, even if they would, give a correct statement of their cargo. Many of the captains, however, have a supreme contempt for statistics, and so do not attempt to fill out the forms furnished to them correctly. Ignorance on the part of the captains also produces inaccuracies. For example, the blanks furnished by the officers of the canal call for a statement of the anthracite and bituminous coal on board, but in some cases these items are not given correctly, because the masters do not know that these forms of coal correspond with hard and soft coal, respectively. After all criticisms have been made, however, it must be said that the "Soo" canal statistics are the best on lake traffic collected by the Government.

Before leaving this subject I must say that the statistics of traffic on the Great Lakes collected by the National Government are simply an object of contempt and ridicule among those engaged in lake transportation. It scarcely needs to be said that the shippers and carriers are fully aware of all the criticisms that I have made. The methods of collecting these statistics ought to be radically changed, if for no other reason, simply because the Government can not afford to permit its work to be held up to scorn. Lake shippers ought gladly to cooperate with the Government, for an accurate knowledge of the situation is absolutely necessary in order to enable Congress to make a wise appropriation of money to facilitate commerce on these waters. Without a positive basis of facts it is impossible to plan a judicious scheme of improvements. Any change in the regulations governing the collection of statistics which will delay traffic may be expected, in the future as in the past, to meet the opposition of the lake carriers. If the shipper instead of the carrier were called upon for a statement, there need be no delay.

TABLE I.

Commerce moved through the Detroit River.

Year.	Registered tonnage.	Freight tonnage.	Year.	Registered tonnage.	Freight tonnage.
1873*a*		9,000,000	1889	19,646,000	*c* 19,717,860
1880*b*	20,235,249		1890	21,684,000	21,750,913
1881	17,572,240		1891*d*	22,160,000	23,209,619
1882	17,872,182		1892*e*	24,785,000	26,553,819
1883	17,695,174		1893*f*		23,091,899
1884	18,045,949		1894*g*	26,120,000	24,263,868
1885	16,777,828		1895		*h* 25,845,679
1886	18,968,065				*i* 29,000,000
1887	18,864,250		1896*j*		27,900,520
1888	19,099,060				

a Brief of the Lake Carriers' Association in opposition to the placing of the bridge piers in the Detroit River, p. 19. This document was prepared by Mr. C. H. Keep, who for some years has been secretary of the Lake Carriers' Association.

b Report on the internal commerce of the United States for the year 1891, p. XXXIX. The figures do not in any case include the tonnage of Canadian vessels, a large number of which use this channel. During the year 1890, according to the estimate by Colonel Poe, 3,500 Canadian vessels, having an aggregate registered tonnage of 350,000 tons, passed through the river.

c For the cargo tonnage of 1889, see Eleventh Census, Transportation Business, Part II, p. 275.

d Annual Report of the Chief of Engineers, 1892, p. 2482.

e Ibid., 1893, p. 3036.

f Ibid., 1894, p. 2378.

g Ibid., 1895, p. 3068.

h Ibid., 1896, pp. 2895, 2896.

i Brief of the Lake Carriers' Association, p. 15. These are Mr. C. H. Keep's figures.

j The statement for 1896 was furnished by Lieut. Col. G. J. Lydecker. The freight tonnage for 1891–1896, as given by the Government engineers, includes staples and only such staples as were shipped on vessels that cleared from some United States port.

TABLE II.

Statement of the commerce through St. Marys Falls Canal for each calendar year from its opening in 1855.

Year.	Date of opening canal.	Date of closing canal.	Tonnage and class of vessels.				
			Sailing vessels.	Steamers.	Unregistered craft.	Total passages.	Registered tonnage.
1855	June 18*	Nov. 23	(*a*)	(*a*)	(*b*)	(*a*)	106,296
1856	May 4	Nov. 28	(*a*)	(*a*)	(*b*)	(*a*)	101,458
1857	May 9	Nov. 30	(*a*)	(*a*)	(*b*)	(*a*)	180,820
1858	Apr. 18	Nov. 20	(*a*)	(*a*)	(*b*)	(*a*)	219,819
1859	May 3	Nov. 28	(*a*)	(*a*)	(*b*)	(*a*)	352,642
1860	May 11	Nov. 26	(*a*)	(*a*)	(*b*)	(*a*)	403,657
1861	May 3	Nov. 14	(*a*)	(*a*)	(*b*)	(*a*)	276 639
1862	Apr. 27	Nov. 27	(*a*)	(*a*)	(*b*)	(*a*)	359,612
1863	Apr. 28	Nov. 24	(*a*)	(*a*)	(*b*)	(*a*)	507,434
1864	May 2	Dec. 4	1,045	366	(*b*)	1,411	571,438
1865	May 1	Dec. 3	602	395	(*b*)	997	409,062
1866	May 5	Dec. 3	555	453	(*b*)	1,008	458,530
1867	May 4	Dec. 3	839	466	(*b*)	1,305	556,899
1868	May 2	Dec. 3	817	338	(*b*)	1,155	432,563
1869	May 4	Nov. 29	939	399	(*b*)	1,338	524,885
1870	Apr. 29	Dec. 1	1,397	431	(*b*)	1,828	690,826
1871	May 8	Nov. 29	1,064	573	(*b*)	1,637	752,101
1872	May 11	Nov. 26	1,212	792	(*b*)	2,004	914,735
1873	May 5	Nov. 18	1,519	968	(*b*)	2,517	1,204,446
1874	May 12	Dec. 2	833	901	(*b*)	1,734	1,070,857
1875	May 12	Dec. 2	569	1,464	(*b*)	2,033	1,259,534
1876	May 8	Nov. 26	684	1,733	(*b*)	2,417	1,541,676
1877	May 2	Nov. 30	1,401	1,050	(*b*)	2,451	1,439,216
1878	Apr. 8	Dec. 3	1,091	1,476	(*b*)	2,567	1,667,136
1879	May 2	Dec. 3	1,403	1,618	100	3,121	1,677,071
1880	Apr. 28	Nov. 15*	1,718	1,735	50	3,503	1,734,890
1881	May 7	Dec. 5	1,706	2,117	181	4,004	2,092,757
1882	Apr. 21	Dec. 3	1,663	2,739	372	4,774	2,468,088
1883	May 2	Dec. 11	1,458	2,620	237	4,315	2,042,259
1884	Apr. 23	Dec. 10	1,709	3,609	371	5,689	2,997,837
1885	May 6	Dec. 2	1,689	3,354	337	5,380	3,035,937
1886	Apr. 25	Dec. 4	2,534	4,584	306	7,424	4,219,397

* Excluded from calculation of average dates.

a No record kept until 1864. *b* No record kept until 1879.

Statement of the commerce through St. Marys Falls Canal, etc.—Continued.

Year.	Date of opening canal.	Date of closing canal.	Tonnage and class of vessels.				
			Sailing vessels.	Steamers.	Unregistered craft.	Total passages.	Registered tonnage.
1887	May 1	Dec. 2	2,562	5,968	825	9,355	4,897,598
1888	May 7	Dec. 4	2,009	5,305	489	7,803	5,130,659
1889	Apr. 15	Dec. 4	2,635	6,501	443	9,579	7,221,935
1890	Apr. 20	Dec. 3	2,872	7,268	417	10,557	8,454,435
1891	Apr. 27	Dec. 7	2,405	7,339	447	10,191	8,400,685
1892	Apr. 18	Dec. 6	3,324	8,737	519	12,580	10,647,203
1893	May 1	Dec. 5	2,955	8,379	674	12,008	8,949,754
1894	Apr. 17	Dec. 6	3,676	10,208	607	14,491	13,110,366
1895	Apr. 25	Dec. 11	4,790	12,495	671	17,956	16,806,781
1896	Apr. 21	Dec. 8	4,391	13,404	820	18,615	17,249,418
1897	Apr. 21	a Dec. 14	4,438	12,029	704	17,171	17,619,933

a Date of closing Canadian canal.

Average date of opening up to close of season of 1893, May 1.
Average date of closing up to close of season of 1893, December 1.

Year.	Passenger and freight traffic.						
	Passengers.	Coal.	Flour.	Wheat.	Grain, other than wheat.	Manufactured and pig iron.	Salt.
		Net tons.	*Barrels.*	*Bushels.*	*Bushels.*	*Net tons.*	*Barrels.*
1855	4,270	1,414	10,289	(a)	----------	1,040	587
1856	4,674	3,968	17,686	(a)	33,908	781	464
1857	6,650	5,278	16,560	(a)	22,300	1,325	1,500
1858	6,230	4,118	13,782	(a)	10,500	2,597	950
1859	----------	8,884	39,459	(a)	71,738	5,504	2,737
1860	----------	----------	50,250	(a)	133,437	----------	----------
1861	8,816	11,507	22,743	(a)	76,830	4,194	3,014
1862	8,468	11,346	17,291	(a)	59,062	6,438	2,477
1863	18,281	7,805	31,975	(a)	78,480	6,681	1,506
1864	16,985	11,282	33,937	(a)	143,560	7,643	1,776
1865	19,777	----------	34,985	(a)	----------	7,346	3,175
1866	14,067	19,915	33,603	(a)	229,926	13,235	4,454
1867	15,120	22,927	28,345	(a)	249,031	20,602	5,316
1868	10,590	25,814	27,372	(a)	285,123	22,785	4,624
1869	17,657	27,850	32,007	(a)	323,501	23,851	5,910
1870	17,153	15,952	33,548	49,700	304,077	42,959	11,089
1871	15,859	46,798	26,060	1,376,705	308,823	54,984	36,199
1872	25,830	80,815	136,411	567,134	445,774	86,194	42,600
1873	30,966	96,780	172,692	2,119,997	309,645	44,920	29,335
1874	22,958	61,123	179,855	1,120,015	149,999	31,741	42,231
1875	19,685	101,260	309,991	1,213,788	250,080	54,381	42,989
1876	30,286	124,734	315,224	1,971,549	407,772	64,091	46,666
1877	21,800	91,575	355,117	1,349,738	343,542	39,971	63,188
1878	20,394	91,856	344,599	1,872,940	264,674	14,882	63,520
1879	18,979	110,704	451,000	2,603,666	951,496	39,218	92,245
1880	25,766	170,501	523,860	2,105,920	2,547,106	46,791	77,916
1881	24,671	295,647	605,453	3,456,965	367,838	87,830	65,897
1882	29,256	430,184	344,044	3,728,856	473,129	92,870	176,612
1883	39,130	714,444	687,031	5,900,473	776,552	109,910	70,898
1884	54,214	706,379	1,248,243	11,985,791	517,103	72,428	144,804
1885	36,147	894,991	1,440,093	15,274,213	422,981	60,842	136,355
1886	27,088	1,009,999	1,759,365	18,991,485	715,373	115,208	158,677
1887	32,668	1,352,987	1,572,735	23,096,520	775,166	74,919	204,908
1888	25,558	2,105,041	2,190,725	18,596,351	2,022,308	63,703	210,433
1889	25,712	1,629,197	2,228,707	16,231,854	2,133,245	57,561	168,250
1890	24,856	2,176,925	3,239,104	16,217,370	2,044,384	116,327	179,431
1891	26,190	2,507,532	3,780,143	38,816,570	1,032,104	69,741	234,528
1892	25,896	2,904,266	5,418,135	40,994,780	1,666,690	101,520	275,740
1893	18,869	3,008,120	7,420,674	43,481,652	2,405,344	89,452	228,730
1894	27,236	2,797,184	8,965,773	34,869,483	1,545,008	60,659	237,461
1895	31,656	2,574,362	8,902,302	46,218,250	8,328,694	100,337	269,919
1896	37,066	3,023,340	8,882,858	63,256,463	27,448,071	121,872	237,515
1897	40,213	3,039,172	8,921,143	55,924,302	24,889,688	135,164	285,449

a None shipped from Lake Superior until 1870.

The traffic through the Canadian Canal, which was opened to commerce September 9, 1895, is included in above statement for seasons of 1895 and 1896.

Statement of the commerce through St. Marys Falls Canal, etc.—Continued.

Year.	Passenger and freight traffic.						
	Copper.	Iron ore.	Lumber.	Silver ore and bullion.	Building stone.	Unclassified freight.	Total freight.
	Net tons.	*Net tons.*	*Feet, B. M.*	*Net tons.*	*Net tons.*	*Net tons.*	*Net tons.*
1855	3,196	1,447	126,000	(a)	(b	(c)	(d)
1856	5,727	11,597	395,000	(a)	(b	(c)	(d)
1857	5,760	26,184	572,000	(a)	(b)	(c)	(d)
1858	6,744	31,035	185,000	(a)	(b)	(c)	(d)
1859	7,247	65,769	.....	(a)	(b)	(c)	(d)
1860	9,000	120,000	.....	(a)	(b)	(c)	(d)
1861	7,645	44,836	394,000	(a)	(b)	(c)	(d)
1862	6,881	113,014	196,000	(a)	(b)	(c)	(d)
1863	1,044	181,567	1,411,000	(a)	(b)	(c)	(d)
1864	5,331	213,753	2,001,000	(a)	(b)	(c)	(d)
1865	9,935	147,459	822,000	(a)	(b)	(c)	(d)
1866	9,550	152,102	144,000	(a)	(b)	(c)	(d)
1867	10,585	222,861	390,000	(a)	(b)	(c)	(d)
1868	12,222	191,939	1,119,000	(a)	(b)	(c)	(d)
1869	18,662	239,368	1,260,000	(a)	(b)	(c)	(d)
1870	11,301	409,850	722,000	92	2,917	(c)	(d)
1871	14,562	327,461	1,072,000	464	5,228	(c)	(d)
1872	14,591	383,105	1,742,000	306	5,213	(c)	(d)
1873	15,927	504,121	1,162,000	580	2,218	(c)	(d)
1874	15,346	427,658	638,000	443	401	(c)	(d)
1875	18,396	493,408	5,391,000	847	2,978	(c)	(d)
1876	25,756	609,752	17,761,000	985	2,102	(c)	(d)
1877	16,767	568,082	4,143,000	987	2,506	(c)	(d)
1878	22,529	555,750	24,119,000	650	2,754	(c)	(d)
1879	22,309	540,075	35,598,000	324	2,226	(c)	(d)
1880	21,753	677,073	44,539,000	66	2,283	(c)	(d)
1881	29,488	748,131	58,877,000	.....	1,400	129,031	1,567,741
1882	25,409	987,060	82,783,000	22	5,428	172,167	2,029,521
1883	31,024	791,732	87,131,000	814	2,405	191,571	2,267,105
1884	36,062	1,136,071	122,389,000	9,731	6,047	207,173	2,874,557
1885	31,927	1,235,122	127,984,000	3,669	8,189	184,963	3,256,628
1886	38,627	2,087,809	138,688,000	2,009	9,449	230,726	4,527,759
1887	34,886	2,497,713	165,226,000	350	13,401	344,586	5,494,649
1888	28,960	2,570,517	240,372,000	3,385	33,541	345,854	6,411,423
1889	33,456	4,095,855	315,554,000	5,947	33,538	312,410	7,516,022
1890	43,729	4,774,768	361,929,000	3,432	47,973	371,294	9,041,213
1891	69,190	3,560,213	366,305,000	1,731	44,080	417,093	8,888,759
1892	64,993	4,901,132	512,814,000	1,930	39,698	459,146	11,214,333
1893	87,530	4,014,556	588,545,000	2,470	19,426	415,180	10,796,572
1894	99,573	6,548,876	722,788,000	412	21,417	451,185	13,195 860
1895	107,452	8,062,209	740,700,000	100	23,876	463,308	15,062,580
1896	116,872	7,909,250	684,986,000	240	17,731	520,851	16,239,061
1897	122,324	10,633,715	805,612,000	5	6,249	579,048	18,982,755

a No record kept until 1870.
b None shipped from Lake Superior until 1870.
c No record kept until 1881.
d No record kept until June, 1881.

Estimated value of freight, by items, through St. Marys Falls Canal, Michigan.

Items.	1887.	1888.	1889.	1890.	1891.
Coal (hard and soft)	$4,735,454	$7,367,644	$5,702,190	$7,619,238	$8,776,362
Flour	7,863,675	10,953,625	11,143,535	16,195,520	18,900,715
Wheat	22,634,590	18,224,424	15,907,217	15,893,022	38,040,239
Grain (other than wheat)	759,652	1,981,862	2,090,580	2,003,496	1,011,462
Manufactured iron	3,035,750	2,442,950	1,577,250	4,680,750	2,128,000
Pig iron	241,468	252,348	442,272	386,104	462,077
Salt	204,908	210,433	168,250	179,431	234,528
Copper	6,977,200	5,792,000	6,691,200	8,745,800	13,838,000
Iron ore	8,741,995	8,996,808	14,335,492	16,711,688	12,460,744
Lumber	2,974,068	4,326,696	5,679,972	6,514,722	6,593,490
Silver ore and bullion	53,826	520,579	914,589	527,807	266,211
Building stone	134,010	335,410	335,380	479,730	440,800
Unclassified freight	20,675,160	20,751,240	18,744,600	22,277,640	25,025,580
Total	79,031,757	82,156,019	83,732,527	102,214,948	128,178,208

Items.	1892.	1893.	1894.	1895.	1896.
Coal (hard and soft)	$10,164,931	$10,528,420	$8,191,917	$6,993,351	$8,452,072.50
Flour	21,672,540	29,682,696	33,621,649	33,383,632	34,199,003.30
Wheat	30,746,085	32,611,239	22,316,469	30,041,863	47,442,347.25
Grain (other than wheat)	933,346	1,346,993	772,504	4,164,347	10,704,747.69
Manufactured iron	2,988,600	2,852,300	1,805,350	3,683,150	4,696,200.00
Pig iron	709,716	550,902	331,452	346,788	377,298.00
Salt	275,740	228,730	237,461	202,439	178,136.25
Copper	12,998,600	17,506,000	19,914,600	21,490,400	23,374,400.00
Iron ore	17,153,962	14,050,946	17,027,078	22,332,319	25,705,062.50
Lumber	9,231,192	10,593,810	11,564,608	8,888,400	8,562,325.00
Silver ore and bullion	296,815	379,861	46,144	11,200	26,880.00
Building stone	396,980	194,260	214,170	238,760	177,310.00
Unclassified freight	27,548,760	24,910,800	27,071,100	27,798,480	31,251,060.00
Total	135,117,267	145,436,957	143,114,502	159,575,129	195,146,842.49

Results obtained from discussion of traffic statistics.

Seasons.	Total mile-tons.	Total cost of transportation.	Cost of carrying per mile-ton.	Average distance freight was carried.	Value of American craft.	Value of Canadian craft.	Proportion of freight carried by Canadian vessels.
			Mills.	*Miles.*			*Per cent.*
1887	4,458,544,804	$10,075,153	2.3	811.4	$17,684,550	$2,089,400	7
1888	5,173,132,972	7,883,077	1.5	806.4	20,381,100	1,514,300	6
1889	5,940,646,352	8,634,247	1.5	790.4	25,328,600	1,597,600	4
1890	7,207,299,415	9,472,215	1.3	797.2	27,857,700	1,777,800	3.5
1891	7,292,462,269	9,849,023	1.35	820.4	31,947,300	2,119,500	4
1892	9,222,773,938	12,072,851	1.31	822.4	36,220,100	2,108,700	3.8
1893	8,980,310,240	9,957,483	1.1	831.9	39,017,400	2,115,700	4.1
1894	10,927,871,324	10,798,310	.99	821.1	41,124,200	1,959,800	3.5
1895	12,502,548,892	14,238,758	1.14	830	40,858,800	2,037,000	3.75
1896	13,582,641,886	13,511,615	.99	836.4	43,006,200	2,135,300	4

TABLE III.

Number and gross tonnage of sailing vessels, steam vessels, and barges, respectively, on the Northern Lakes. a

Fiscal year.	Sailing vessels.		Steam vessels.		Barges.		Total.	
	Number.	Tons.	Number.	Tons.	Number.	Tons.	Number.	Tons.
1851	.....	138,000	.....	74,000	.....	.....	.....	214,000
1862	1,152	257,689	350	125,620	.....	.....	1,502	383,309
1868	1,855	293,978	624	144,117	64	15,957	2,543	454,052
1869	1,752	277,893	636	146,237	103	22,072	2,491	446,202
1870	1,699	264,609	642	142,973	114	27,570	2,455	435,152
1871	1,662	267,153	682	149,468	132	31,208	2,476	447,829
1872	1,654	270,051	708	162,523	161	37,863	2,523	470,437
1873	1,663	298,002	802	180,250	177	42,559	2,642	520,811
1874	1,696	336,801	876	198,121	216	46,323	2,788	581,245
1875	1,710	339,787	891	202,307	193	45,140	2,794	587,234
1876	1,643	331,498	921	201,743	188	45,585	2,752	578,826
1877	1,604	324,394	923	201,085	192	47,207	2,719	572,686
1878	1,546	315,909	918	201,550	183	45,296	2,647	562,755
1879	1,473	307,078	896	203,298	170	42,226	2,539	552,602
1880	1,459	304,932	931	212,045	165	40,965	2,555	557,942
1881	1,417	306,436	988	260,115	162	41,453	2,567	608,004
1882	1,412	313,652	1,101	292,257	164	42,906	2,677	648,815
1883	1,373	310,454	1,149	304,642	156	43,575	2,678	658,671
1884	1,333	307,733	1,165	322,456	126	34,099	2,624	664,288
1885	1,322	313,129	1,175	335,859	111	30,810	2,608	679,798
1886	1,235	282,319	1,280	381,908	101	26,132	2,616	690,359
1887	1,286	315,079	1,225	390,398	84	21,758	2,595	727,235
1888	1,277	314,765	1,342	480,138	78	18,194	2,697	813,097
1889	1,285	325,083	1,455	575,307	44	7,274	2,784	907,664
1890	1,272	328,656	1,527	652,923	54	13,910	2,853	995,489
1891	1,243	325,131	1,592	736,752	62	20,472	2,897	1,082,355
1892	1,226	319,617	1,631	763,063	69	25,321	2,926	1,108,001
1893	1,205	317,789	1,731	828,702	82	37,732	3,018	1,184,223
1894	1,139	302,985	1,731	843,240	85	39,215	2,955	1,185,440
1895	1,100	300,642	1,755	857,735	81	39,008	2,936	1,197,385
1896	1,044	309,152	1,792	924,631	81	45,175	2,917	1,278,958
1897	993	334,104	1,775	977,235	101	60,783	2,869	1,372,122

a These figures, with the exception of those for the years 1851 and 1862, were obtained either directly from the Commissioner of Navigation or from his annual reports. Those for 1851 were obtained from Andrew's Report on Colonial and Lake Trade (1852), Thirty-second Congress, second session, House Executive Document No. 136, p. 49; and those for 1862 from Internal Commerce of the United States (1891), p. x. As has been explained in the text, all rigged vessels are classed with the sailing craft. Thus most of the vessels commonly regarded as barges are grouped with the sailing vessels, for most of them carry some canvas. Nearly all the old schooners are now regularly towed, and therefore can not be regarded as sailing vessels, in the old sense of this term.

TABLE IV.

Statement showing class, number, and gross tonnage of vessels built and documented on the northern lakes.a

Fiscal year.	Sailing vessels.		Steam vessels.		Barges.		Total.	
	Number.	Tons.	Number.	Tons.	Number.	Tons.	Number.	Tons.
1860	.....	.....	20	5,011	.....	.....	.....	.....
1861	.....	.....	20	2,377	.....	.....	.....	.....
1862	.....	.....	41	9,308	.....	.....	.....	.....
1863	.....	.....	73	13,578	.....	.....	.....	.....
1864	.....	.....	157	70,669	.....	.....	.....	.....
1865	.....	.....	48	6,425	.....	.....	.....	.....
1866	.....	.....	45	4,761	.....	.....	.....	.....
1867	.....	.....	36	8,595	.....	.....	.....	.....
1868	129	22,490	64	11,282	28	4,238	221	38,010
1869	83	14,462	77	13,339	35	5,458	195	33,259
1870	69	10,322	49	7,196	9	3,289	127	20,807
1871	60	13,839	46	12,293	19	3,795	125	29 927
1872	57	12,962	60	15,926	15	4,019	132	32,907
1873	112	40,840	105	21,418	23	6,818	240	69,076
1874	130	43,851	99	24,487	22	4,733	251	73,071
1875	62	12,269	70	12,490	11	1,620	143	26,379
1876	35	2,507	79	8,972	6	2,469	120	13,948
1877	29	2,686	39	3,802	4	551	72	7,039
1878	33	1,505	55	8,644	2	130	90	10,279
1879	30	1,173	44	11,542	5	579	79	13,294
1880	48	5,447	65	14,306	8	1,356	121	21,109
1881	52	12,936	109	49,080	14	3,111	175	65,127
1882	66	16,164	130	34,100	5	1,988	201	52,252
1883	34	6,437	100	17,253	3	1,158	137	24,848
1884	29	7,667	80	20,206	1	10	110	27,883
1885	30	3,861	64	20,229	5	768	99	24,858
1886	15	5,232	47	12,648	5	412	67	18,292
1887	35	4,991	75	47,183	8	378	118	52,552
1888	48	9,131	140	87,459	2	468	190	97,058
1889	32	8,098	145	93,707	5	678	182	102,483
1890	36	12,803	116	86,023	12	6,739	164	105,565
1891	30	7,240	123	93,323	11	6,853	164	107,416
1892	41	3,474	93	34,129	8	5,449	142	43,053
1893	21	9,277	126	76,161	11	11,867	158	97,305
1894	16	5,473	71	34,889	6	429	95	40,791
1895	22	8,166	58	26,516	2	446	82	35,128
1896	19	21,825	75	75,744	14	10,185	108	107,754
1897	26	39,151	43	61,787	26	12,722	95	113,660

a The figures covering the steamboat construction from 1860 to 1867, inclusive, were taken from Tenth Census, Transportation (Vol. IV), p. 669. The others were either furnished to me directly by the Commissioner of Navigation or obtained from his annual reports.

TABLE V.

Average gross tonnage of sailing and steam vessels built on the northern lakes.

Fiscal year.	Sailing vessels.	Steam vessels.	Fiscal year.	Sailing vessels.	Steam vessels.
1868	174.34	176.28	1885	128.70	316.07
1869	180.26	173.23	1886	348.80	269.10
1870	149.59	146.85	1887	142.60	629.10
1871	230.65	267.22	1888	190.22	624.70
1872	227.40	265.43	1889	253.05	646.25
1873	364.64	203.99	1890	355.65	741.57
1874	337.31	247.34	1891	241.34	758.72
1875	197.88	178.29	1892	84.74	366.98
1876	71.62	113.57	1893	441.76	604.45
1877	92.60	97.48	1894	304.05	491.39
1878	45.60	157.15	1895*a*	144.86	457.17
1879	39.10	262.32		371.16	
1880	113.47	220.09	1896	581.46	1,009.91
1881	248.77	450.28		1,148.69	
1882	244.90	262.31	1897	301.37	1,436.91
1883	189.31	172.53		1,505.80	
1884	264.39	252.56			

a The upper figures of the years 1895–1897, in the column headed sailing vessels, represent the average of the sailing vessels after the tonnage of the steel sailing vessels has been removed. The steel sailing vessels are commonly known on the lakes as barges. The average should be still further reduced, as several large wooden barges have been built in recent years. In the years previous to 1895, steel sailing vessels (barges) were constructed, but I do not know their tonnage.

TABLE VI.

Gross tonnage constructed on the northern lakes, showing material used.a

Fiscal year.	Wooden tonnage.	Iron and steel tonnage.	Fiscal year.	Wooden tonnage.	Iron and steel tonnage.
1880	20,082	2,817	1889	73,068	29,415
1881	67,673	5,831	1890	66,964	38,602
1882	52,041	6,328	1891	49,428	57,989
1883	28,593	45	1892	14,594	28,459
1884	26,233	1,650	1893	34,480	62,825
1885	15,678	9,180	1894	20,851	19,950
1886	14,071	4,221	1895	11,932	23,195
1887	46,475	6,078	1896	27,330	80,424
1888	81,085	20,018	1897	13,281	100,379

a These figures were obtained either directly from the Commissioner of Navigation or from his annual reports. Iron has been used only to a very limited extent about the great lakes; the third column is composed almost wholly of steel tonnage. The total iron tonnage now afloat probably does not exceed 35,000 tons.

TABLE VII.

Average freight rates on wheat (per bushel) from Chicago to New York by lake and canal, by lake and rail, and by all rail.

Calendar year.	By lake and canal. *a*	By lake and rail.	By all rail.	Calendar year.	By lake and canal. *a*	By lake and rail.	By all rail.
	Cents.	*Cents.*	*Cents.*		*Cents.*	*Cents.*	*Cents.*
1857	*b* 25.29	.....	.....	1877	11.24	15.80	20.50
1858	16.28	.....	*c* 38.61	1878	9.15	11.40	17.70
1859	17.59	.....	34.80	1879	11.60	13.30	17.74
1860	24.83	.....	34.80	1880	12.27	15.70	19.80
1861	26.55	.....	41.58	1881	8.19	10.40	14.40
1862	26.33	.....	48.00	1882	7.89	10.90	14.47
1863	22.91	.....	49.20	1883	8.37	11.50	16.20
1864	28.36	.....	60.00	1884	6.31	9.55	13.20
1865	26.62	.....	44.88	1885	5.87	9.02	13.20
1866	29.61	.....	46.20	1886	8.71	12.00	15.00
1867	22.36	.....	44.75	1887	8.51	12.00	15.75
1868	22.79	*b* 29.00	37.84	1888	5.93	11.00	14.50
1869	25.12	25.00	35.57	1889	6.89	8.70	15.00
1870	17.11	22.00	30.00	1890	5.85	8.50	14.30
1871	20.24	25.00	31.80	1891	5.96	8.53	15.00
1872	24.47	28.00	34.99	1892	5.61	7.55	13.80
1873	19.19	26.90	31.02	1893	6.33	8.44	14.63
1874	14.10	16.90	26.25	1894	4.44	7.00	13.20
1875	11.43	14.60	24.00	1895	4.11	6.95	11.89
1876	9.58	11.80	16.86	1896	*d* 6.19	6.61	12.00

a Including canal tolls until 1882, but not Buffalo transfer charges.
b Statistical Abstract, 1896, p. 327.
c Report of the Chicago Board of Trade, 1895, p. 115.
d The rates for 1896 were obtained from Report of the Chicago Board of Trade, 1896, p. 115; the lake and canal rate for 1896 includes Buffalo charges.

Freight rates on wheat (per bushel) by lake from Chicago to Buffalo.a

Year.	Currency.b	Gold.c	Year.	Currency.	Gold.
	Cents.	*Cents.*		*Cents.*	*Cents.*
1857	9.89	.....	1878	3.07	3.027
1858	3.76	.....	1879	4.74	.....
1859	5.08	.....	1880	5.76	.....
1860	9.89	.....	1881	3.44	.....
1861	11.53	.....	1882	2.50	.....
1862	10.49	10.234	1883	3.41	.....
1863	7.51	5.175	1884	2.18	.....
1864	9.58	6.160	1885	2.02	.....
1865	9.78	4.523	1886	3.68	.....
1866	12.34	8.808	1887	4.13	.....
1867	6.67	4.995	1888	2.56	.....
1868	7.14	5.155	1889	2.51	.....
1869	6.81	5.022	1890	1.96	.....
1870	5.88	4.847	1891	2.38	.....
1871	7.62	6.883	1892	2.19	.....
1872	11.46	10.504	1893	1.66	.....
1873	7.62	6.761	1894	1.27	.....
1874	4.03	3.617	1895	1.92	.....
1875	3.42	3.040	1896 *d*	1.63	.....
1876	2.90	2.570	1897 *e*	1.56	.....
1877	3.72	3.502			

a Out of the rates received the vessel must bear charges for trimming, tallying weights, and shoveling in the hold to elevator legs when unloading. In 1896 these charges aggregated $4.75 per 1,000 bushels, or nearly one-half cent per bushel; in 1897 they were reduced to about $4.35.

b The rates were obtained from the reports of the New York Produce Exchange.

c In converting currency prices into gold I have used the value of gold in currency as given for January of each year in the American Almanac for 1878.

d Report of Chicago Board of Trade, 1896, p. 113.

e Marine Record, Dec. 16, 1897, p. 8.

PART II.

I.—FLOUR AND GRAIN TRAFFIC.

Previous to 1850 the importance of the great interior water routes can not easily be overestimated. The commerce of the great agricultural States of the West drifted to the two great natural waterways, the Mississippi River running to the south, and the Great Lakes and their eastern outlets, the Erie Canal and the Welland Canal, in conjunction with the St. Lawrence River, running to the east. Although the West possessed these two unrivaled waterways, yet there were but few localities which could choose between the two. Physical conditions usually left no choice. To the settler near the lakes the eastern route was the only available highway, and to the farmer living near the banks of the Mississippi the river was the only possible route. This was the case because land transportation was well-nigh impossible. The value to the States bordering on the Great Lakes of the lake and canal route from the date of the opening of the latter in 1825 down to the middle of the century, and even for a number of years thereafter, is incomputable. Over the Great Lakes and through the canal passed the bulk of the surplus products of the West and practically the whole of the merchandise shipped from the East to the West.

To realize fully the importance of the water routes, even up to a comparatively late day, it is necessary to understand the services it was intended the early railroads should render. They were designed to connect waterways, not to compete with them. Before the construction of railroads the traffic of the country that was other than local in character moved upon and to and from one of our four great waterways. These were the Atlantic Ocean on the east, the Great Lakes and the Erie Canal and St. Lawrence on the north, the Mississippi River and its tributaries on the west, and the Gulf of Mexico on the south. This being the situation, the railroads which were intended to serve anything more than local needs sought to cooperate with one of these waterways, and the projectors of nearly all the railroads which it was hoped would become trunk lines sought to connect two or more of the four great water routes. The construction of the great trunk lines clearly shows this, and nothing could more strongly emphasize the importance of the lake route at this early day than the uniformity with which the railroads sought it. A glance at a railroad map of the later fifties will also clearly show that the water routes formed the base of all the great transportation systems. In some cases, it is true, the water routes were paralleled, but these instances were comparatively rare, and even in these cases the railroads were not regarded as competitors of the water routes for through traffic in heavy commodities. Passenger traffic, local business, and through freight in the more valuable commodities were the main reliance of the railroads.

This state of affairs, however, was very much changed in the twenty years covered by the period from 1860 to 1880. These two decades were replete with improvements in rail transportation. Advances, to be

sure, were also made in water transportation, but the progress made in land carriage during this interval was much the greater. Limitations of space forbid a detailed presentation of the improvements introduced that made the railroads effective competitors of the lake carriers. Nothing more than an enumeration of the most important advances can be attempted. Progress was made in all departments. The permanent way was improved by reduction of grades, better alignment of track, improved drainage and ballasting, and better bridges. But far more important than these improvements was the introduction of steel rails. It is doubtful if the railroads could ever have become effective competitors of the lake carriers without steel rails, for the latter, although of transcendent importance in themselves, became doubly significant because of the advance along various lines that they made possible. The greatest of these improvements was made in the rolling stock. With stronger tracks much heavier engines could be built, and cars could be loaded more heavily. Steel was in a measure substituted for iron in the construction of locomotives. A great saving was made by the change from iron to steel tires. With a very slight increase in the dead weight of cars, the carrying capacity was doubled. There was also great progress made in making up and running trains.

The consolidation of connecting lines (and the extension of other lines by lease or by purchase or by new construction) which had set in before 1860 became a feature of railroad history during the period covered by the years intervening between 1860 and 1880. By consolidation the cheap and expeditious movement of freight between distant points was greatly furthered. About the largest expense of transportation in the early days was the transshipment charges. Consolidation did much to obviate the necessity of frequent transfers of freight. But even after consolidation had made considerable progress the extended movement of bulky freight remained subject to many delays and charges, due to transshipment at connecting points. These evils were in a large measure overcome by the organization of through freight lines. But one more advance can be mentioned—it is scientific rate making. This has revolutionized railroad transportation. In the primitive days of railroading the toll sheets showed but little differentiation of charges. The principle of charging what the traffic would bear was never applied with anything like thoroughness. The decisive change in rate making came when it was recognized that it may be profitable to establish a rate which will result in a net gain, however small, above the expenses arising strictly from the mere handling and moving of freight and such incidental expenses as are properly applicable to it. In other words, it is not always to be insisted upon that any given traffic must bear its full share of the total expenses of the road. The question is, rather, Will this traffic form a profitable auxiliary of the existing traffic?

By the early seventies the long list of improvements which have been enumerated, and others of less importance, but nevertheless of great moment in the aggregate, had progressed so far as to change the relation existing between the lake carriers and the railroads.[1] The latter were now in a position to enter into effective competition with the lakes in the transportation to the seaboard of the agricultural products of the West. As a very large portion of the east-bound traffic from the West was at this time composed of agricultural products, nearly the entire east-bound business now became competitive.[2] In 1876 it was

[1] Long before this the railroads had demonstrated their ability to compete with canals.

[2] In this statement is not included the lumber and ore traffic of what is known as the Lake Superior region.

estimated that grain and flour constituted about 50 per cent of the entire eastward movement of through freights.[1]

It must not be understood that rail rates—from Chicago to New York, for example—were now as low as the lake rates, for such was not the case. Rail rates had, however, fallen so much that, taken in connection with several advantages offered by rail transportation, rail rates were as favorable as the lake rates, even though the latter were slightly lower. It may be well at this point to state that the published transportation charges are not to be accepted without modification. The lake charges are approximately correct; but the rail charges are generally too high, and often very much too high. The latter are averages of the officially published tariffs; but men in a position to speak authoritatively say that practically no grain is shipped at these rates.[2]

When grain moves eastward to the seaboard in large quantities by rail during the navigation season it may be assumed, with considerable assurance, that the through rail rate is very nearly as low as the lake and rail rate. This must be the case, because the advantages of through rail shipment over lake and rail are not sufficient to offset any large difference in rates. These advantages will be briefly stated. Railroads are responsible for the safe delivery of goods placed in their care. The shipper, therefore, does not insure his property, which he would feel obliged to do should he send his property by the way of the lakes.[3]

Grain carried in cars during the seasons of the year when grain is likely to heat arrives in better condition than if sent by water. Grain already out of condition goes better by rail, but not much importance is now to be attached to this point, as grain is generally put in good condition before it is shipped.[4]

Expedition is sometimes desirable, and railroads deliver commodities with greater dispatch than the lake carriers. The terminal facilities of the railroads are better than those of the water lines, and by patronizing the railroad shippers can occasionally save considerable sums in the form of cartage charges. This is more true of flour, corn, and oats than of wheat, for the last is not delivered directly to consumers, but is first delivered to millers, who have terminal facilities. Flour, corn, and oats, on the other hand, although generally not delivered directly to consumers, are, however, delivered to persons at least one step nearer the consumers than are the millers who receive the wheat. During the process of transshipment there is some loss of grain, but as the lake carriers deliver the amount for which they give receipts the shipper loses nothing. In this particular the shipper rather favors the lake route, for the railroads refuse to receipt for a definite amount, and as a consequence any loss in transit falls upon the shipper unless he can clearly prove that there was a loss in transit, which he usually finds very difficult to do.

In case the grain is not forwarded on a through bill of lading a portion of the cost of transshipment falls upon the shipper, and thus enters as one of the deciding influences in the selection of a route.

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[1] Internal Commerce of the United States, 1876, p. 67. The total shipments east from Chicago during the year 1878 amounted to 4,862,385 tons; to this sum grain, flour, seeds, and feed contributed 3,137,032 tons, or a little more than 64 per cent. Almost the whole of the balance was made up of animals and their products. (Ibid., 1879, p. 99.)

[2] For transportation rates see Appendix II, Table VII.

[3] In 1872 the rate of insurance was about $1 on $100. (Transportation Routes to the Seaboard, vol. 1, p. 17.) It is now about 30 cents on $100.

[4] All the modern elevators are equipped with apparatus for airing and drying grain.

Grain carried by "wild" vessels,[1] that is, vessels which have no rail connections and are not running under contract, but fix their rates from day to day as business may determine, is not carried on through bills of lading, and the owner of the grain would therefore pay the elevator charges.[2] Terminal charges have undoubtedly been in some measure responsible for the diversion of the grain traffic from the lake route; they may be found in Appendix II, Tables I and II.

When the railroads found that they could successfully compete with the waterways it was discovered that the lack of suitable terminal facilities at the seaboard cities for transferring grain from cars to ocean vessels and for storage became a serious handicap. Down to about 1865 none of the trunk lines possessed elevator facilities on the Atlantic Coast. At this time there was an elevator built at a wharf on the Delaware, in Philadelphia, under the patronage of the Pennsylvania Railroad Company, and this was probably the first stationary elevator erected on the Atlantic Coast.[3] Up to the close of the year 1870 the Baltimore and Ohio Railroad Company was the only road which had already provided adequate terminal facilities for the handling of grain.[4] New York City, although the chief port of the export grain business, did not possess a single stationary elevator.

The use of elevators would have necessitated the adoption of the western method of handling grain by "grades." The custom of selling grain on sample had become too firmly fixed by fifty years of habit to be easily uprooted, and especially so as such a departure would seriously impair the value of enormous vested interests of the very persons who were expected to make the change. The great expense involved in the old method of handling grain if shipped in bulk at the railroad terminals, and the great reductions made by the introduction of elevators, will be seen by the following statement made up by the general freight agent of the Baltimore and Ohio Railroad:

"Previous to January, 1872, all grain shipped to Baltimore in bulk was unloaded by hand, at an expense of from 4 to 5 cents per bushel. At this time the company completed an elevator of 600,000 bushels capacity and reduced the charge for receiving, weighing, wharfage, delivering to vessels, and storing for ten days to 1¾ cents per bushel, by which means also the detention to vessels in loading was reduced from five or ten days to as many hours."[6]

Two years later, when the Baltimore and Ohio entered Chicago and became an aggressive competitor for a share in the movement of agricultural products from the West, all the other trunk lines were forced to improve their terminal facilities. Without proper facilities for handling grain at the seaboard no road could meet the competition of the lake and canal route, for this line possessed fairly satisfactory terminals. The transfer charge of from 4 to 5 cents was sufficient to turn grain to the lake and canal route. Not only was the movement of grain by rail checked by the high charges at the seaboard terminals, but it was at times entirely inhibited by the lack of facilities for removal of grain from cars. Mr. C. M. Gray, assistant general freight agent of

[1] The "wild" vessels of the lakes are the tramp vessels of the ocean.

[2] Charges for shoveling and trimming the grain in the hold of the ship are paid by the vessel.

Development of Transportation Systems in the United States, Ringwalt, p. 211.

[4] Report of the Select Committee on Transportation Routes to the Seaboard, Vol. I, p. 27.

[5] Ibid., Vol. II, p. 346.

[6] Ibid, Vol. I, p. 27.

the Lake Shore and Michigan Southern Railroad, in testifying before the Senate Committee on Transportation Routes to the Seaboard, stated that the lack of terminal facilities at the seaboard for promptly unloading cars had resulted in such a shortage of cars on the Pittsburg, Fort Wayne and Chicago, and Michigan Central in the winter of 1872-73 that these roads were practically forced to suspend the movement of bulky freight for a period of six weeks because of a lack of cars. His own road, the Lake Shore and Michigan Southern, was reduced to such straits by the dearth of cars that it was forced "to cut off all freight west of Chicago and receive nothing except the local freight of Chicago."[1]

Up to within very recent times our Government has taken but little interest in our internal commerce, and has therefore collected but little information concerning it, and thus it is impossible to set forth as definitely and accurately as might be desired the diversion of the grain business from the Great Lakes to the railroads and from the latter back to the former. We shall in the main be forced to rely for statistics upon the reports of the commercial bodies of the cities chiefly concerned in the grain business, and unfortunately they have not collected as full or accurate information as could be desired. From the two sources, however, enough information can be obtained to present in a rough way the change that has taken place; but this can not always be done in the simplest manner.

The diversion of the flour and grain traffic from the lakes to the railroads and from the railroads back to the lakes will be considered under the following heads: (1) The diversion of the flour and grain business as shown by the movement of these commodities by lake and rail from Chicago;[2] (2) the diversion (if any there be) as shown by such data as we have of the total eastward movement; and (3) the export movement from the West through the Gulf ports will be examined—it is not only a diversion from the lake line, but also from the east-bound trunk lines.

II.—THE LAKE AND RAIL TRAFFIC EASTWARD FROM CHICAGO.

In the early sixties the railroads began to make serious inroads into the flour traffic from Chicago, and during the eighth decade secured the lion's share of this business. Flour was the first heavy commodity of comparatively low value that the railroad carried in competition with the water lines. The railroads gained this traffic, partly because shipment by lake to points not accessible to lake craft involved a transshipment, and flour could not be transferred with the same ease and facility that grain could be transshipped; partly because expeditious delivery is frequently demanded, the element of time being of much greater importance in the movement of flour than that of grain, and, finally, because flour can not be stored without considerable loss, so it would not be held during the winter for the opening of navigation to so large an extent as grain. To these causes may be added a fourth—the cost of marine insurance. The diversion from the lakes to the railroads of the traffic in flour will be seen from the table in Appendix II, Table III, Part I. It will be noted that from the opening of the seventh decade the railroads rapidly monopolized the business, and continued to do so until the year 1886. Since 1885 the relative importance of the rail lines has diminished. In 1885 they carried almost seven-eighths of

[1] Transportation Routes to the Seaboard, Vol. II, p. 280.

[2] A table showing the lake and rail movement of flour and grain from Milwaukee may be found in Appendix II, Table IV

the flour shipped eastward from Chicago, while in 1896 they carried but a little more than three-fifths.[1]

For many years the long-distance traffic of the railroads was almost wholly confined to the transportation of live animals, provisions, and general merchandise. As we have seen, however, at a comparatively early day the railroads secured a large portion of the flour business. In 1872[2] they became in the fullest sense competitors of the lakes for the wheat traffic. Up to this time, although they had in various years carried considerable quantities of wheat, they had never been regarded by the lake carriers as serious rivals.

In the spring of 1872 the railroads entered the field for a part of the grain traffic and secured a liberal portion of it throughout the season of navigation. In the following year the struggle was continued, the railroads securing a large share of the business. Since 1873 the contest has been maintained. In some years the railroads have made great encroachments into the traffic, and in other years the lake carriers have almost monopolized the business. Shipments by rail exceeded those by lake in 1881, and again in 1885. Since the latter year the lakes have more than held their own, and in some years have captured nearly all the wheat. The yearly movement by each mode of transpor-

[1] It will be seen by the table in the appendix that the east-bound movement of flour from Chicago reached its maximum volume in 1887. Until 1888 most of the flour shipped from the Northwest passed through Chicago, but in 1888, by the completion of the Minneapolis, St. Paul and Sault Ste. Marie Railway, much of the flour business was diverted from Chicago. From 1882 the construction of a railroad from Minneapolis and St. Paul to the north of Lake Michigan and the lower lakes to the seaboard had been much discussed by the millers and shippers of these two cities. Such a line, it was hoped, would be of signal advantage to the interests of these two cities and of the entire Northwest, for by this road not only the distance to the seaboard would be materially shortened in comparison with the circuitous route around the head of Lake Michigan, but the uncertainty of a speedy movement through the freight yards of Chicago would also be obviated. This line, commonly known as the "Soo," in connection with the Canadian Pacific and lake vessels, on its completion at once became a strong competitor for the flour and grain business of the Northwest. During its first year it forwarded from Minneapolis 931,500 barrels of flour, and since then shipments have rapidly increased, as will be seen by the subjoined table.

The yearly shipments of flour from Minneapolis over the "Soo," as given in the reports of the Minneapolis Chamber of Commerce, have been as follows:

Year.	Barrels.	Year.	Barrels.	Year.	Barrels.
1888	931,502	1891	1,200,642	1894	1,458,146
1889	1,367,792	1892	1,684,005	1895	2,111,455
1890	1,156,516	1893	1,720,166	1896	2,419,914

Since 1887 shipments of flour to the ports at the head of Lake Superior have also greatly increased, and the combined rail and water routes through Wisconsin and across Lake Michigan have secured a large traffic that formerly passed through Chicago.

[2] The following table covers the period in which the great change took place:

Eastward shipments of wheat from Chicago.

Year.	By lake.	By rail.	Year.	By lake.	By rail.
	Bushels.	*Bushels.*		*Bushels.*	*Bushels.*
1870	13,429,069	2,621,699	1873	15,528,984	8,149,209
1871	12,120,923	576,468	1874	16,974,149	9,725,251
1872	8,831,870	2,363,810			

tation since 1860 is shown by the figures given in Appendix II, Table III, part 1.

In the years previous to 1873, with some exceptions, most of the wheat taken from Chicago by the railroads was secured in the winter months, when lake navigation was closed. Since 1873 the largest rail shipments have often been made after the navigation season had fully opened.[1]

In shipping by rail the marine insurance is avoided, the grain is less liable to damage in transit, is moved more rapidly and marketed more readily, thus giving quicker returns and thereby saving interest charges. But these advantages combined were not sufficient to overcome the additional rail charge which was frequently exacted. It is safe to say that the marine insurance in all but exceptional cases was considerably less than 1 per cent per bushel, and the difference in time between the all rail and lake and rail was not a large factor. The danger from heating in special cases would be very great, but in most cases it would quite disappear. During May, 1875, the difference in rates amounted to 10 cents, and with such a variation it is surprising that the railroads should have secured any wheat at all. With a fuller knowledge of the situation, however, this will be readily understood. The published rates were not the real rates. Says Mr. E. H. Walker, statistician of the New York Produce Exchange: "During a portion of the year 1875, the transportation by rail has been by the agreed schedule of rates."[2]

The implication is that rates were generally not maintained, and such must have been the case. From January to October the rates given in the Internal Commerce reports remained stationary at 24 cents per bushel, then fell 1 cent for October, but recovered for November, and rose to 28 cents for December.[2]

The statistician of the New York Produce Exchange[3] says that rates were very low from the opening of the year until October, when they advanced very sharply, but the published rates do not show this movement. He also informs us that flour and grain were carried in large quantities from St. Louis to New York by all rail at 24 cents per

[1] The seriousness of the competition offered by the railroads at times during the navigation season will be made evident by the following table:

Year.	Shipments during the month of May.		Nominal difference of rates in favor of the lake and rail route as against the all-rail route.
	By lake.	By rail.	
	Bushels.	*Bushels.*	*Cents.*
1872	272,591	340,584	2
1873	1,823,310	947,902	6
1874	2,367,796	1,210,352	7
1875	1,160,435	735,666	10
1876	1,810,340	1,114,137	1
1877	755,962	270,110	3.6
1878	902,958	1,369,732	3.1

For this data see Internal Commerce, 1876, charts 2 and 3, and Internal Commerce, 1879, Appendix, pp. 246–247. The third column of the table shows a surprising amount of freight secured by the railroads in view of the great difference which frequently obtained in rates. Perhaps the published rates were not adhered to.

[2] New York Produce Exchange, 1874–75, p. 231.

[3] Internal Commerce of United States, 1876, chart No. 1.

[4] New York Produce Exchange, 1874–75, pp. 231–235.

100 pounds, which would be equivalent to 15 cents through the St. Marys is hardly to be supposed that the rate from Chicago was maintained at 24 cents, with a rate of 15 cents fro That railroad rates were not stable during the year 1875 is als to by Mr. Charles Randolph, in his report as secretary for the Board of Trade.[2]

In a general way it may be said that the corn traffic has followed the same course as the wheat traffic. The railroads appear, however, to have secured a considerable share of this business at an even earlier time than they obtained a large part of the wheat traffic. During the years 1868, 1869, and 1870 the railroads carried considerable quantities of corn, and then for five years transported but little of this commodity. In the movement of this important crop the year 1876 was the decisive turning point. The crop of corn grown in 1875 was large and of good quality and the export demand was steady and strong, so the grain was moved rapidly forward by rail. Throughout 1876 the rail routes competed vigorously with the lake lines and obtained a large share of the traffic. During the months of May and June 6,208,706 bushels of corn were shipped from Chicago by lake, and 5,588,830 bushels by rail.[3] The amount of corn carried by rail during the year 1884 was almost equal to that transported by lake. During the following year the shipments by rail again almost equaled those by lake, the amounts being, respectively, 28,682,864 and 29,382,591 bushels. Since 1885 the lakes have regained much of the east-bound traffic lost in the earlier years. In 1896 they carried more than six times as much corn as the railroads.

We have now considered the partial diversion from the lakes to the railroads of the flour, wheat, and corn shipped from Chicago to the East. There yet remains to be considered the movement of oats, the one grain not yet taken up that is shipped eastward in large quantities. Rye and barley, the other important cereals, are not transported in sufficient amounts to warrant separate treatment. During 1896 the aggregate shipments by lake and rail from Chicago amounted to but 11,142,217 bushels.[4] Their movement may be inferred in a general way from the discussion of the transportation of the other grains.

At a very early date, as will be seen by an examination of Table III, part II, Appendix II, the transportation of oats by rail assumed an important position. During 1862, 1863, 1864, and 1865 a very large portion of the oats carried out of Chicago was taken by the railroads. This was largely due to the exceptional conditions which prevailed. The principal contracts let all over the United States for supplying the armies in the South with oats were filled in Chicago. As a result, the shipment of oats from Chicago during the war increased with surprising rapidity; for the year 1861 they amounted to only 1,492,507 bushels, while for the last nine months of 1864 and the first three months of 1865 they reached the large total of 15,020,792 bushels.

As a natural consequence the railroads leading from Chicago were called upon to transport much of this grain, and as there were no railroads running far to the South west of the Mississippi, and but a single road crossing the Ohio River and running to the South through Kentucky, it became necessary to send commodities to the southeastern points by the roundabout eastern lines. After the war closed the

[1] New York Produce Exchange, 1874–75, p. 232.
[2] Report of Chicago Board of Trade, 1875, pp. 18, 19.
[3] Internal Commerce, 1876, chart No. 3. Navigation opened before the 1st of May.
[4] Report of Chicago Board of Trade, 1896, p. 3.

tation since 1860 is ... by rail diminished somewhat, but very shortly III, part 1.

In the years ... rapid rate, and in 1873 the shipments by rail greatly taken from those by lake. From 1873 to 1886 the railroads secured when lake ... the whole traffic, and in some years left but an insignificant have ... to the lake carriers. Since the latter year the vessel men have ... entered the field for this business and now obtain a large portion of ..., but the railroads still hold the larger share.

The statistics of the movement of oats show that the railroads carried a larger proportion of this than of other grains. This is surprising, for oats is a commodity of comparatively low value and large bulk, and it is generally held that this class of goods is best adapted to water transportation. The explanations of the larger rail movement of oats are not far to seek; one of them, however, runs counter to long-established opinion. Oats take up moisture more readily than other grains, and as a very small amount will cause oats to become musty and thus unfit for horse feed, it is sometimes found advantageous to ship this grain by rail. But there is another and far more potent cause for the surprisingly large rail movement of oats. It is the lake rates; these are fixed more upon the basis of bulk than of weight, and as oats is a bulky[1] product, the freight per hundred pounds is considerably higher than on wheat and corn.

Enough oats can not be stowed away in the hold of a ship to secure a cargo equal in weight to that of the same ship loaded with wheat, and therefore it is necessary to fix a higher rate per hundred pounds upon oats than upon wheat. The grain car, on the other hand, is so large that there is no difficulty in loading it to its full carrying capacity with the bulky product oats, and as a consequence the rail rates on oats are no more per hundred pounds than those on wheat and corn. The larger lake movement of oats in recent years is perhaps in part explained by the fact that since the agitation for deeper channels began vessels have been constructed, to draw more water when fully loaded than the existing channels would permit. This being the situation, many vessels, so to speak, would have extra cargo room or unoccupied space when transporting heavy commodities. These vessels, to a certain extent, would suffer no loss in carrying the bulky product oats, for if they carried wheat or corn a part of the hold would remain empty.

III.—THE TOTAL EAST-BOUND TRAFFIC.

An almost entire absence of statistics of the grain and flour transported over the railroads that tap the surplus grain-producing regions stretching far out to the south, west, and north of Chicago, makes it wholly impossible to present anything approaching a satisfactory exposition of the general movement of these commodities. Thus far nearly all the facts we possess have been gathered under the direction of the commercial organizations of the cities in which the grain and flour business is centered.[2]

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[1]The numbers 32, 56, and 60 represent, with a fair degree of accuracy, the weights of a like bulk of oats, corn, and wheat, respectively. The measured bushel of oats weighs about 32 pounds, that of shelled corn 56, and that of wheat 60; the measured bushel of oats, however, more frequently exceeds 32 pounds than does that of wheat exceed 60 pounds. Recently there has been a machine invented for "clipping" oats. By "clipping" the weight of the measured bushel is increased by one-half to one and one-half pounds.

[2]The statistics published by these organizations are generally in part based upon the custom-house records. For the sources of the grain statistics see Appendix II.

While these data are complete enough for [illegible] ugh the St. Marys not sufficiently comprehensive to disclose the [illegible] utterly general movement of the cereals from the interior [illegible] s far p[illegible] the consuming districts of the East and South, and [illegible] f the c[illegible] Thus far, our General Government has devoted but [illegible] ed. Ti[illegible] inland commerce; the reports on our internal commerce [illegible] tates du[illegible] appeared up to this time have contained but little stati[illegible] moven[illegible] which had not previously appeared in reports of transpo[illegible] panies, boards of trade, produce exchanges, and chambers of [illegible] York a[illegible] of our great trading centers.

Receipts at Buffalo and Erie.

I shall now attempt to show, but in a somewhat roundabou[illegible] on what share of the flour and grain traffic from the West to the Ea[illegible]st ha[illegible] fallen to the lakes, and what portion has been secured by the railroa[illegible]ds. The figures which will be given should in no case be wrested from thei[illegible] context. Conditions which obtained at the beginning of the period under consideration no longer exist, and thus the statistics standing by themselves would be very misleading.

The transportation of flour and the chief three cereals—corn, wheat, and oats—will be investigated. In the case of each one of these commodities, the receipts at the principal eight Atlantic ports will be compared with the receipts by water at the chief lower lake ports. If the receipts at the Atlantic ports increased at a more rapid ratio than those of the lake ports it may be legitimately inferred, if all circumstances except those of transportation remain unchanged, that the railroads were proving the stronger competitor, and vice versa. The conditions, however, as will be shown as each commodity is considered, have not remained fixed.

Attention is first invited to the movement of wheat; the transportation of flour will next be taken up. The order of consideration has been purposely changed, because the movement of flour is partially explained by the circumstances which have affected the alterations in the shipment of wheat. A very large portion of the grain shipped by lake is received at Buffalo and Erie, and therefore the receipts of these two ports may be regarded as fairly representing the lake movement.[1] Moreover, the relation between the receipts of grain at these ports and the other lower lake ports has not materially changed; so, for comparative purposes, the amounts received at Buffalo and Erie may be assumed as reflecting the whole movement by lake. In the comparisons which will be instituted, the total receipts at the lower lake ports by lake have not been used, for the reason that such statistics can not be had except for the census year 1889.

The impossibility of securing statistics of the entire movement to and through the Atlantic States and the eastern portion of Canada has forced me to accept the receipts[2] at the chief centers of the grain and flour business on the Atlantic Seaboard as indicative of the whole movement into the regions just mentioned. It thus appears that the value of the comparison turns (1) upon the accuracy with which the lake movement is reflected by the receipts at Buffalo and Erie, and (2) upon the permanence of the proportion existing between the total movement

[1] Insufficient data make it difficult to give an estimate of the relation between the receipts of Buffalo and Erie and those of all the lower lake ports, but it is probably safe to say that the receipts of Buffalo and Erie are 80 per cent of the total.

[2] Instead of the receipts at Newport News and Norfolk, I have used the exports, for the latter alone represent the traffic which may be regarded as competitive between the lakes and the railroads. The other ports selected are Montreal, Portland, Boston, New York, Philadelphia, and Baltimore.

tation since 1860 is due to the selected ports. As has already been
III, part 1.
In the year ... rapient by vessel to the lower lake ports. As to whether
taken from those been the total movement to the seaboard and that
when lake ports has remained the same, we can not speak with the
have ... to the, for we have but few statistics to assist us in forming
... the exports of wheat seem to have maintained a fairly
..., but the ... tion to the total production of wheat in the United States,
The situations being left out of account, it may be assumed that
ried a ... ts at the seaboard ports of wheat for export have not varied
for oa... The question then remains as to whether or not the total
it is ... ts at the seaboard ports, less the quantities exported, have
... ased at as rapid a rate as the receipts at all the other points com-
...ed. This question must probably be answered in the negative, and
... two reasons: In the earlier years of the period under considera-
tion the smaller interior cities seldom enjoyed as favorable freight rates
as the larger cities, and so the former often obtained their supplies from
the latter; and in the earlier years, when the Eastern States produced a
large portion of the wheat consumed, the smaller cities of the localities
where the grain was raised would be sure to obtain the surplus, leav-
ing the larger cities to look to the more remote regions for the satisfac-
tion of their necessities.

By examining Table V, Part I, in A... that from
the beginning of the period und...
1876, the combined receipts of
although varying from year to ...
large as those of the selected Atla...
slightly changed, and for the first
ports were more than double those of ...
however, no great change, as the receipts at the former ports were
42,881,000 bushels, and at the latter 21,147,090. During 1877 the lake
ports regained their former position, the receipts being 25,791,491
bushels, while the receipts at the Atlantic ports were 46,828,000 bushels.
Thus far the relation existing between the receipts at the lower lake
ports and at tidewater on the Atlantic Coast have remained fairly con-
stant, although the aggregate receipts have increased appreciably. A
great change took place during the next five years. The ratio between
the receipts at the lower lake ports and the Atlantic ports was very
much altered; instead of being about as 1 to 2, the ratio was now about
as 1 to 3½; for the five-year period the aggregate stood at 172.6 million
and 548.6 million bushels, respectively. For the year 1881 the receipts
at the Atlantic ports were more than four times as large as the re-
ceipts at Buffalo and Erie. In 1883 there was a partial return to the
relations which formerly obtained, and in 1884 there was a still further
change, so that for this year the receipts at the Atlantic ports lacked
just a trifle of being double those of the lake ports. For the three
succeeding years there was no great change. But in 1888 and in the
following year the situation changed so much that for the year 1895
the receipts at Buffalo and Erie almost equaled those of the selected
Atlantic ports, the receipts of the former being 49,033,160, and of the
latter 49,205,000 bushels. This proportion during 1896 was changed
somewhat in favor of the Atlantic ports.

Thus far nothing but the superficial facts have been presented. These
seem to show that the railroads and the lakes maintained a pretty even
struggle during the decade beginning with 1868, and that for five years

thereafter the railroads gained a decisive advantage ...ugh the St. Marys years waged a stubborn contest, but only to be utterly ... field in the years from 1888 to 1896. The facts thus far p... ever, are wholly inadequate for an understanding of the ... have ...ken place. Conditions have radically changed. Ti... ...he history of wheat growing in the United States du... ...rty years has been the westward and northward moveu... ...plus wheat-producing areas.[1]

...ceipts at ...ffalo ...Erie.

the beginning of the period under consideration, New York a... ...sylvania held prominent places among the wheat-producin... ...tes, and the great wheat raising States were for the most part on... ...southern shores of the chain of Great Lakes. By the middle of the ...ghties all this was changed and a large proportion of the surplus ...heat grown in the United States was harvested in the far Northwest, the Dakotas and Minnesota being the principal wheat-growing States. The last column of the foregoing table discloses the present importance of these States, two of which produced no surplus wheat until the middle of the period under examination. The westward and northward movement of the wheat-raising areas has had a very decisive influence in the selection of the agencies employed in the movement eastward of the grain produced. When the grain to be shipped was raised in Ohio and Indiana and in the southern portions of Michigan and Illinois it was almost sure to go by rail, for in nearly all cases shipment by water would involve a short rail haul to the lakes, with its high local rates, and in some cases, after the grain reached the lake, it would be only slightly advanced in its eastward journey by lake shipment. Charges of transshipment in the case of the short lake shipment would be of relatively greater importance than in the case of the larger lake shipment. In the early days the grain grown in the West was produced in regions or carried to places where the railroads were in a favorable position to compete for it. Most Western wheat found its way to Chicago or Milwaukee.

[1] In speaking of the great wheat-producing areas, I refer only to the wheat-growing regions east of the Rocky Mountains. The shifting of areas is made clear by the following table:

Production of wheat.

[,000 omitted.]

1869. *a*		1879. *b*		1889. *c*		1895. *d*	
State or Territory.	Yield.	State or Territory.	Yield.	State or Territory.	Yield.	State or Territory.	Yield.
	Bush.		*Bush.*		*Bush.*		*Bush.*
Illinois	30,128	Illinois	51,111	Minnesota	52,300	Dakotas	90,319
Iowa	29,436	Indiana	47,285	Dakotas	40,945	Minnesota	65,584
Ohio	27,982	Ohio	46,015	Illinois	37,389	Ohio	32,216
Indiana	27,747	Michigan	35,533	Indiana	37,319	Kansas	22,919
Wisconsin	25,616	Minnesota	34,601	Ohio	35,559	Pennsylvania	20,456
Pennsylvania	19,673	Iowa	31,154	Kansas	30,399	Indiana	20,294
Minnesota	18,866	Missouri	24,967	Missouri	30,114	Illinois	19,061
Michigan	16,265	Wisconsin	24,885	Michigan	24,771	Missouri	18,499
Missouri	14,315	Pennsylvania	19,462	Pennsylvania	21,505	Michigan	15,238
New York	12,178	Kansas	17,324	Wisconsin	11,699	Nebraska	14,787
Kentucky	5,729	Nebraska	13,847	Kentucky	10,707	Iowa	13,655
Kansas	2,390	New York	11,588	Nebraska	10,571	Kentucky	9,501
Nebraska	2,125	Kentucky	11,356	New York	8,305	Wisconsin	8,616
Dakota	171	Dakota	2,830	Iowa	8,250	New York	7,301

a Ninth Census: Industry and Wealth, p. 83.
b Tenth Census; Vol. III, p. 177.
c Report on the Statistics of Agriculture in the United States at the Eleventh Census, p. 16.
d Report of the Chicago Board of Trade, 1895, p. 182.

tation since 186[illegible] III, part 1. [illegible]nts the railroads possess a decided advantage over [illegible]s in the point of distance, for the latter must round the [illegible]ula of Michigan, while the former run directly across [illegible]their destination. From Chicago to Buffalo by lake is 889 [illegible]mile the distance from Chicago to New York City by the [illegible] rail route is but 912 miles.[2]

[illegible]m Buffalo to New York City by the shortest rail route is 410 miles.[3] Thus appears that every mile covered in the passage to Buffalo by lake results in an effective eastward movement of 0.564 mile. By the westward and northward movement of the surplus wheat-producing region the situation has been wholly changed. The districts which formerly produced the surplus that was almost certain to go by rail now grow but little if any more wheat than will satisfy their own necessities, but the location of the new wheat-growing areas is the important factor. These districts are located directly west of Lake Superior. This fact is clearly shown by the crop maps of the Eleventh Census.[4] The production of wheat in the far North has been greatly increased since these maps were published, as will be seen by an examination of the table on page 41. As a result of this northward and westward movement of the wheat fields, the railroads have lost the advantage in point of distance which they formerly possessed. By the shifting of the wheat-growing districts the lake carriers have been placed upon terms of substantial equality with railroads. In shipping by lake from Chicago it was found that every mile traversed in the passage to Buffalo resulted in effective eastward movement of but 0.564 mile. Shipment by water from the head of Lake Superior is not accompanied by this wasteful expenditure of energy. Every mile the grain is moved results in its being practically 1 mile nearer one of our great exporting ports.[5]

The increased importance of the shipments of wheat from the far Northwest, in the receipts at Buffalo and Erie, is made clear by the

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[1] Eleventh Census: Transportation Business, Part II, p. 290.

[2] Chicago to New York City over the Pennsylvania Railroad. By rail the distances from Chicago to the different seaboard cities are as follows:

	Miles.		Miles.
To Boston	1,000	To Newport News	896
To Baltimore	802	To Norfolk	984
To Philadelphia	822		

(Railroad Gazette, Vol. XXIX, No. 13, p. 215.)

[3] From Buffalo and Erie the distance to the seaboard ports by the shortest routes is as follows:

	Miles.		Miles.
Buffalo to New York	410	Erie to New York	512
Buffalo to Boston	481	Erie to Boston	569
Buffalo to Philadelphia	418	Erie to Philadelphia	506
Buffalo to Baltimore	402	Erie to Baltimore	490

(Ibid., p. 216.)

[4] Eleventh Census: Statistics of Agriculture; Crop Map No. 13.

[5] In comparison with certain rail routes, however, the lake route from the head of Lake Superior does not appear in this favorable light. Either the Duluth, South Shore and Atlantic, or the Minneapolis, St. Paul, and Sault Ste. Marie, in connection with the Canadian Pacific, affords a much shorter line to an ocean port (Montreal) than do the lakes and the railroads to any of our Atlantic ports. These all-rail lines may in the future effectively compete with the lake carriers in the transportation of grain to certain regions. It does not follow because these roads have not done so in the past that they will not do so in the future. The discussion of this point, however, would lead us too far afield, and therefore it will not now be taken up.

following table, covering the movement of wheat through the St. Marys Falls Canal:

Movement of wheat.

[000 omitted.]

Year.	Movement through St. Marys Falls Canal.	Receipts at Buffalo and Erie.	Year.	Movement through St. Marys Falls Canal.	Receipts at Buffalo and Erie.
	Bushels.	*Bushels.*		*Bushels.*	*Bushels.*
880	2,106	44,477	1891	38,817	83,749
	3,729	27,680	1892	40,995	86,085
	11,986	34,692	1893	43,482	71,578
	18,991	42,575	1894	34,869	52,450
	18,596	27,865	1895	46,218	49,033
	16,217	25,034	1896	63,256	60,054

e table it appears that the movement of wheat through lls Canal now just about equals the combined receipts nent lower lake ports—Buffalo and Erie. Were the lower lake ports no larger than the shipments from ts other than those of Lake Superior the receipts of the lantic ports would have much more than held their own with pts of Buffalo and Erie. A comparison upon this basis would thless, however, because the whole situation has changed. That ailroads are less able to compete with the lake route than formerly not be inferred from a comparison of the receipts of the lower lake ts and of the Atlantic ports, for the railroads never were competitors the traffic of the far-off region which now produces the bulk of our rplus wheat. The existing status of the struggle between the railad and the water lines will not be discussed further at this point.

The statistics for the transportation of flour show that the movement of this commodity very much resembles that of wheat. For the first three years (1868–1870) of the period under consideration the receipts at Buffalo and Erie were about one-fifth of those at the selected Atlantic ports. Then for several years, but not without occasional setbacks, the receipts at the seaboard ports gained on the receipts of the lower lake ports, until in 1877 the receipts of the former ports were more than ten times as large as those of the latter. After 1877 there was a reverse movement, and in 1883 this had gone so far that the relations which obtained at the outset were about restored. During the next two years there was practically no change, but in 1886 the lake ports made a decided gain upon the seaboard ports, and in 1889 increased this gain so much that the receipts of the lake ports were more than one-half as large as those of the seaboard ports. Since 1889 there has been no change of note. The yearly alterations which took place are shown in Appendix II, Table V, Part I.

A strong resemblance in the movement of flour and of wheat will be noticed on comparing the figures (in the Appendix) covering the movement of flour with those presenting the movement of wheat. The general tendencies have been in the same direction, but the movement has not proceeded so far in the one case as in the other. The shifting of the surplus wheat-producing districts has been accompanied by a corresponding movement of the great milling centers. From 1878 Minneapolis has, with but few interruptions, steadily increased her output of flour, reaching the enormous total of 12,874,890 barrels in 1896. At the

head of Lake Superior, in the cities of Duluth and West Superior, there has recently sprung up another important milling center.[1]

As the milling industry has in a large measure followed the wheat-growing region westward and northward, it follows that the lakes are now in a more favorable position for competing for the flour traffic than formerly. That a large portion of the increased receipts of Buffalo and Erie originate in the Northwest is evidenced by the statistics of the flour moved through the St. Marys Falls Canal.[2]

The shipments from Minneapolis by the Minneapolis, St. Paul and Sault Ste. Marie Railroad have the same effect, since the bulk of the flour carried by this road is transshipped to lake vessels at Gladstone, a port on the northern shore of Lake Michigan.

It appears, then, that the shipments of flour through the St. Marys Falls Canal, plus the shipments of flour from Minneapolis by the Minneapolis, St. Paul and Sault Ste. Marie Railroad, are now about as large as the total receipts of Buffalo and Erie. For 1895 the former were actually larger than the latter.[3] This brings us to the main considera-

[1] The subjoined table will show the development of these two milling districts.

Annual production (barrels).

[000 omitted.]

Year.	Minneapolis.a	Duluth.b	Year.	Minneapolis.a	Duluth.b
1878	941	.....	1890	6,989	431
1880	2,052	.....	1891	7,878	673
1882	3,176	.....	1892	9,750	1,094
1884	5,318	.....	1893	9,378	876
1886	6,168	.....	1894	9,401	918
1888	7,057	.....	1895	10,582	c2,978
1889	6,089	84	1896	12,875	d3,120

a Reports of the Trade and Commerce of Minneapolis.
b Reports of the Trade and Commerce of Duluth.
c The output of the Duluth and West Superior mills.
d Flour manufactured at the "Head of the Lakes." (Review of the Trade and Commerce of Duluth, compiled by the Duluth Chamber of Commerce.)

[2] *Movement of flour (barrels).*

[000 omitted.]

Year.	Through the canal.a	From Minneapolis, by Minneapolis, St. Paul and Sault Ste. Marie R. R.b	Year.	Through the canal.a	From Minneapolis, by Minneapolis, St. Paul and Sault Ste. Marie R. R.b
1880	524	.....	1891	3,780	1,201
1882	344	.....	1892	5,418	1,684
1884	1,248	.....	1893	7,421	1,720
1886	1,759	.....	1894	8,966	1,458
1888	2,191	931	1895	8,902	2,111
1890	3,239	1,368	1896	8,883	2,420

a Statement of the commerce through the St. Marys Falls Canal, a document prepared by Mr. E. S. Wheeler, the Government officer in charge of the canal.
b Reports of the Chamber of Commerce of Minneapolis.

[3] This fact does not, however, throw discredit upon the method of approaching the problem of the general eastward movement of the several commodities under investigation, for the total shipments of flour from Minneapolis by the "Soo" Railroad are not transshipped to lake vessels. And the receipts at Buffalo and Erie do not represent the total receipts of the lower lake ports as fully as the shipments through the "Soo" Canal, plus the shipments over the "Soo" Railroad, represent the shipments from the upper lake ports. It should also be remembered that at the outset I disclaimed all intentions of making an exact mathematical demonstration.

tion. We find in the case of flour, as in the case of wheat, that the shifting of the places of production has put the water carriers in a more favorable position to meet the competition of the railroads. The lake carriers are no longer handicapped by an excessively circuitous route.[1]

In striking contrast with the movement of wheat and its manufactured product, flour, is the eastward movement of corn. It appears from Appendix II, Table V, Part II, showing the receipts of the selected lake and seaboard ports, that the receipts of these two groups of ports, although they have varied greatly during the period under consideration, have moved together and at about the same rate. From 1868 to 1876 the lake receipts were about one-half as large as those of the seaboard, then for half a dozen years the seaboard receipts gained somewhat upon the receipts of the lake ports. The year 1882 was, in some respects, anomalous. The receipts of the lake ports almost equaled those of the seaboard ports, the former being a little more than 24,000,000 bushels and the latter somewhat more than 28,000,000.[2]

For the next four years there were wide variations, and from then (1887) the lake receipts, with the exception of 1892, were somewhat more than one-half as large as those of the seaboard receipts. During 1896 the seaboard receipts were more than double those of the lake ports, the former being 113.5 million and the latter but 54.7 million bushels.

The eastward movement of corn thus stands out in strong contrast with that of wheat and flour. In our investigation of these breadstuffs we found that after the opening of the eighties the transportation of these commodities by water gained very rapidly upon the movement by land, and that at the close of the period the quantities received at Buffalo and Erie by water were practically equal to the total quantities received at the leading seaboard cities. The explanation of this divergence of tendencies is not far to seek. It is found in the fact that the shifting of the surplus corn producing region has been westward, and not northward as well as westward; it has been along the parallels. Our surplus wheat, as was seen, is now largely grown in the far Northwest—in Minnesota and in the Dakotas. The great wheat fields are now back of Lake Superior, and thus in a favorable position for the movement by lake of the crops gathered from them. These States have thus far produced but little surplus corn, and will probably never produce much, as they lie almost wholly without the corn belt. In the southern portions of Minnesota and South Dakota corn can be grown successfully, but these areas are limited in extent. The great surplus corn region now lies to the west and southwest of the southern portion of Lake Michigan,[3] falling within the States of Illinois, Iowa, Missouri, Kansas, and Nebraska, and, as a consequence, if corn is to go by water to the East it must be carried from the ports at the head of Lake Michigan on the circuitous journey around the lower peninsula of Michigan. The advantages of the rail lines running to the Atlantic ports in point of distance will not be further discussed, as this matter has already been dwelt upon.

As the surplus corn producing regions now lie to the southwest of the head of Lake Michigan rather than directly to the west of it, there

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[1] For qualifications, see note on page 42.

[2] The receipts of this year were far below the normal, and in this fact is to be found the explanation of the variation of the relation. Just why a small movement should affect the seaboard receipts more than the lake receipts will be shown later.

[3] This is very clearly shown by Crop Map No. 9, Eleventh Census: Statistics of Agriculture.

has been a very decided tendency to ship corn for export by the all-rail lines to the south Atlantic ports, notably Baltimore, Philadelphia, Newport News, and Norfolk. Shipments by the all-rail routes to these ports will probably increase. The distances from the corn growing districts to the south Atlantic ports are less than to the north Atlantic ports. There is another reason, and a much weightier one, for the movement to the southern ports from Chicago. Philadelphia has a differential rate in its favor of 2 cents, and the other ports one of 3 cents per 100 pounds as compared with New York. When these differentials were agreed upon, April 5, 1877, they were given to Southern ports to offset the advantage New York possessed in the matter of ocean rates.[1]

Since 1877, however, the situation has radically changed. New York has, in good part, lost the advantage she then possessed in the item of ocean rates, and thus the reason for the existence of these differentials has disappeared. The differentials, however, not only remain, but have become much more effective than when adopted. Nominally the differentials remain as they were fixed in 1877, but really they are much higher than they were then. This is true because the rates have fallen very decidedly, while the differentials have remained absolutely stationary. Had the differentials been fixed upon a sliding scale, falling as the rates fell, the Southern ports would not have the advantage which they now possess. What might have been easily arranged in 1877 can now be brought about only by a serious struggle, and one which the Northern trunk lines are not likely to make. The grain traffic is an important item to the Southern roads, and they will wage a desperate struggle to retain it. This is fully recognized by the more prosperous Northern roads, which have a more profitable miscellaneous business. We have here a case of a wide difference in marginal utility of a certain traffic to two different sets of roads. The Baltimore and Ohio, the Chesapeake and Ohio, and the Norfolk and Western—roads hungry for traffic—set a much higher value upon the traffic in corn, which at best yields but a small profit, than do the New York Central and Pennsylvania roads, whose terminal yards are already crowded and can only be enlarged at a great outlay of money.

As these Southern roads also tap the territory to the south and west of Chicago, it may be expected that they will also, to an increasing extent, divert grain directly to the Southern ports, instead of permitting it first to go to Chicago and then to take it to those ports. A large portion of the surplus corn being produced in the territory to the south of Chicago, this diversion may seriously affect the corn trade of this city.

The table covering oats shows that its eastward movement differs widely from that of each of the other commodities considered. For the first four years of the period under investigation, namely, 1868 to 1872, the receipts by lake at Buffalo and Erie were almost equal to one-half the receipts of the eight selected Atlantic ports, the former being 33.8 million and the latter 68.5 million bushels. Beginning with the year 1872 the receipts of the lower lake ports not only declined relatively, but even absolutely, and in the year 1880 reached the very small aggregate of 1,654,350 bushels. For the next four years the receipts were somewhat larger, but in 1885 they again fell very low, being less than the small amount received in 1880. The receipts at the Atlantic ports, on the other hand, steadily rose from 23.7 millions in 1880 to 40.4 millions of bushels in 1885. In 1886 the lake receipts increased slightly,

[1] Proceedings of the special committee on railroads appointed under a resolution of the New York assembly to investigate alleged abuses in the management of railroads chartered by the State of New York, 1879, Vol. III, pp. 3041, 3042.

and those of the seaboard ports fell off somewhat. Since 1886 the receipts of the lake ports have grown much more rapidly than those of the Atlantic ports, the receipts of the former ports for 1896 being 40.5 million and those of the latter 78.9 million bushels.

While investigating the transportation of wheat and corn, it was found that the shifting of the great producing areas was a factor of prime importance in determining the route by which the crops would go to market. In the case of oats, the movement was very largely westward and but slightly northward; so the situation has not been so greatly changed as in the case of wheat. Most of the surplus oats is now grown in territory directly west of Chicago. There has been, however, something of a northward movement of the oats-growing districts, and the shipments by the northern routes—by lake from the head of Lake Superior and by the Minneapolis, St. Paul and Sault Ste. Marie Railroad—have increased very rapidly, and in a measure explained the unusually large receipts at Buffalo and Erie in 1896. It may be expected that shipments over the northern lines will increase largely, and therefore Chicago may lose the prominent position she has so long maintained in the handling of this grain.

It has now been shown to what extent the railroads encroached upon the flour and grain traffic once monopolized by the lakes, the causes have been briefly dwelt upon which enabled the railroads to make these inroads, and the periods have been given when the greatest incursions were made. Attention was also directed to the fact that since the middle of the last decade the lake carriers have regained much of the traffic lost in the earlier years. But this was not fully explained; in part it was shown to be due to the shifting of the surplus grain-producing regions. But nothing in the way of an explanation was attempted of the fact that the lake carriers had been more successful in their struggle with the railroads for traffic from the old competitive points, such as Chicago and Milwaukee. This was done designedly, as it was thought best to postpone examination of this matter until this stage of this discussion had been reached.

Antiquated methods of doing business prevailed on the lakes until the middle of the last decade. It is not to be understood that there had been no progress in any of the departments of lake transportation, for such was not the case. Upon the whole, however, lake transportation had not availed itself of the advances made in science and the mechanical arts. The railroads, on the other hand, had been alert to introduce one improvement on the heels of another. For example, the railroads had profited fully a decade and a half by the series of inventions which resulted in cheap steel before the lake carriers began to use steel to any appreciable extent. Methods of doing business on the lakes were also out of date; modern methods have only recently been introduced. It took the lake carriers a decade to realize that the railroads had become worthy competitors. No attempt will be made to show in detail the revolution that has taken place since 1885; the improvements will be discussed in their proper setting. Suffice it to say that the era of metal ships of great capacity propelled by steam, and dock and harbor facilities for giving these vessels dispatch in loading and unloading date from this period. It is needless again at this point to dwell upon the importance of proper dock facilities. A vessel in port is not performing the function for which she was built—namely, carrying freight—and therefore earns nothing. It is not to be understood that there was a great and sudden improvement in lake transportation in the year 1886 and that as a result the lake carriers obtained a much larger share of the east-bound traffic than in 1885. The improve-

ments were not far-reaching enough to account for the change. The sudden success of the lake carriers was rather due to the termination, in November, 1885, of a ruinous struggle between the trunk lines, during which they had at times carried goods at far below remunerative rates.

IV.—THE TRAFFIC THROUGH THE GULF PORTS.

Not only have the east and west trunk lines diverted traffic from the lakes, but the Mississippi River and the railroads leading to the Gulf have done so as well. This southern movement, however, never assumed large proportions until the year 1896, and for this year the growth was largely accounted for by the increased movement of corn. Our total exports of corn last year having been unusually large, it may be supposed that the sudden prominence of the Gulf ports[1] in the shipment of grain is ephemeral. But such a view is hardly justifiable. If the Mississippi River were the only competing route to the Gulf ports, the southern route would not greatly encroach on the traffic now moving over the lakes and the east and west trunk lines. But the Mississippi is no longer the only line seriously competing with the great east and west routes to the Atlantic ports.

The railroads leading to the Gulf are in certain sections competing with the great east and west routes. As regards the railroads east of the Mississippi River, this is especially true of the Illinois Central, which has recently completed very excellent terminal facilities at New Orleans for handling grain. The small export movement of grain via New Orleans in past years has been largely due to the inadequate terminal facilities at that point. Although there may be an increased grain traffic over the Illinois Central, this enlarged business will not to any great extent be at the expense of the lake route. Grain grown in the territory but a short distance south of Chicago and east of the Mississippi River does not go east over the lake route, for this is effectually prevented by the high local rates for the short haul to the lake ports. It need hardly be said that if the lakes can not monopolize the flour and grain traffic from points situated immediately upon the lakes, such as Chicago and Milwaukee, they can not successfully compete for the shipment of these commodities from points south of Chicago. The Senate select committee, appointed in 1872 "to investigate and report upon the subject of transportation between the interior and the seaboard," took the position that "the railroad interests practically control the transport of grain from all that part of the States of Illinois and Indiana situated south of a latitudinal line 60 miles south of Lake Michigan."[2]

The railroad interests here referred to did not include the railroads running to the Gulf, but merely the lines running to the seaboard. The grain produced in the region some little distance south of Chicago for the most part has been, and in all probability will continue to be, carried to the Atlantic ports. The railroads leading to the Gulf have no advantage over some of those running to the Atlantic in point of distance[3]; and,

[1] For the exports from the leading two Gulf ports, New Orleans and Galveston, see Appendix II, Table VI. The exports rather than the receipts are given, because the former alone represent competitive business.

[2] Report of the Select Committee on Transportation Routes to the Seaboard, page 24 (Forty-third Congress, first session). Mr. Windom was chairman of the committee.

[3] From Chicago to New York, 912 miles; from Chicago to Philadelphia, 822 miles; from Chicago to Baltimore, 802 miles; from Chicago to Newport News, 896 miles; from Chicago to New Orleans, 926 miles. (The Railroad Gazette, quarto vol. xxix, No. 13, p. 215.) The distance to New Orleans is that given in the folder of the Illinois Central Railroad, and is the distance over that line.

as ocean freight rates to European ports are materially higher than those from Atlantic ports, and as the Gulf railroads obtain but little return freight, it is difficult to see how these lines are going to draw much traffic in the territory east of the Mississippi River and north of St. Louis from the northern trunk lines, and it is still much more difficult to understand how the south-bound lines will encroach upon the traffic which has gone over the lakes. The south-bound lines have easy grades and are not troubled with snow and ice; but these advantages are not sufficient to offset the disadvantages under which they operate.

An entirely different problem is presented by the movement of flour and grain from the regions west of the Mississippi. In this territory the railroads leading to the Gulf will probably carry a great deal of grain to the Gulf ports that formerly went to the Atlantic ports over the rail and lake route and the all-rail lines. Roughly speaking, the grain grown in the territory north of the east-and-west line passing through the southern boundary of Iowa will continue to go over the eastern rail and water line. And probably the grain produced in northeastern Missouri will continue to move over the old routes. On the other hand, the grain grown in Missouri south of the Missouri River and in the southern half of Kansas, and in all the region lying south of these two States, will probably go, if intended for export, by the south-bound lines to the Gulf. Between these two regions lies a district of debatable territory, formed of the northern half of Kansas, the southern part of Nebraska, the extreme southwestern part of Iowa, and of northwestern Missouri. This region includes much of the best agricultural land of the country west of the Mississippi River. It may therefore be expected that the eastern lines will not relinquish the traffic of this territory without a struggle.

As the railroads leading to the Gulf have erected or are erecting terminal facilities for the handling of grain on a large scale, particularly at their southern termini, they may be expected to wage a spirited contest for the traffic of the disputed territory, and, as a consequence, grain rates to the Atlantic Seaboard and to the Gulf will probably fall in the near future. The most southern of the east-and-west trunk lines of the Central Traffic Association were pressed by the association to maintain rates, and as a result they saw much of the traffic which they at one time handled go to the Gulf by the river and rail lines. The southern lines of the Central Traffic Association did not regard this traffic as valuable enough to warrant them in breaking loose from the association, and the association preferred to lose some traffic to the Gulf lines rather than reduce rates on all east-bound grain traffic to such a point as would prevent grain from the southern limits of their territory from finding an outlet through the Gulf ports. Although the Central Traffic Association viewed with equanimity the diversion of a portion of its traffic to the Gulf ports, it does not follow that the association will much longer permit the diversion to the Gulf ports of the traffic originating in the territory which has supplied the railroads forming the association with much of their east-bound freight.

Up to the present time the rail and water lines and the all-rail lines to the Atlantic Seaboard have regarded themselves as the natural heirs to the whole of the traffic originating in or destined for the entire West. To the lake carriers and the managers of the east-and-west trunk lines the westward course of empire has always presented itself as new traffic for them. For many years there was an increasing tendency of commerce to move on east-and-west lines. The opening of the Erie Canal, in 1825, gave the first decisive impulse to commerce to move

across the country instead of down the Ohio and Mississippi rivers. In later years the construction of the great trunk lines, parallel to the northern water route formed by the Great Lakes and Erie Canal strengthened a movement which had already become firmly established. On the Atlantic Seaboard, New York, Boston, and Philadelphia had come to be looked upon as the natural outlets and inlets for the commerce of the whole country; and, in a like manner, Chicago, by reason of its favored position on the lakes and its excellent railroad facilities, had come to be viewed as the natural distributing and receiving point for the entire West.

This idea that Chicago was to be the gateway through which the commerce to and from the West would move received a severe shock some years ago. As the farmer has pushed westward and still farther westward, it has become easier and easier to make a flank attack upon the old lines of commerce. This has been rendered doubly easy where the new regions settled have been either north or south of the great east-and-west line of movement. It has already been shown how, with the westward and northward migration of the wheat fields, the wheat and flour traffic avoided Chicago and sought the more northern routes. Most of this business still goes through our chief Atlantic ports, but with the rapid enlargement and improvement of Canadian transportation facilities now in progress it will be surprising if Canadian ports, notably Montreal, do not secure a larger portion of the export grain business.

Let us now return to the movement of flour and grain through the Gulf ports. The old east-and-west routes have recently been brought face to face with a new and serious situation in the central West and Southwest. The lines extending northward from the Gulf are not disposed to allow the east-and-west lines to control this great traffic of the transmississippi region. The Gulf roads hold that the central West and Southwest should export their surplus products through the Gulf ports and receive imports through the same cities. This proposition is nothing short of revolutionary. It means a breaking away from the old channels of shipment through Chicago and New York and the other eastern cities; further, it means that the northern water route and the eastern trunk lines are no longer to be the dominant power in moving the products of western farms. During the past year the railroads running to the Gulf have been increased in number by the construction of the short line—the Kansas City, Pittsburg and Gulf Railroad.[1] This line, which was designed to make Kansas City independent of the eastern routes, extends from Kansas City almost due south to Port Arthur (Tex.), at the head of Sabine Lake, an arm of the Gulf. In the contest which is already on with the east-and-west lines this route will be found in the van. The distance to tidewater from Kansas City is much less by the Port Arthur route than by the eastern rail routes, and therefore very much less than by the way of the Great Lakes.[2] But too much must not be expected from this route simply on the ground of its being much shorter than the eastern lines to tidewater.

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[1] It is commonly known as the Port Arthur route.

[2] The following table of short-line rail distances from Kansas City will make this clear:

	Miles.		Miles.
New York	1,303	Galveston	799
Philadelphia	1,228	Port Arthur	767
Baltimore	1,198		

(Manufacturers' Record, February 19, 1897, p. 2.)

It need hardly be said that cost of service does not vary as the distance and that rates are not fixed on a mileage basis. Easy grades, straight tracks, a large traffic in both directions, and cheap fuel are fully as important as the question of distance. So far as the first two items are concerned, the Port Arthur route will compare very favorably with any of the Eastern trunk lines; it can also secure fuel as cheaply as most of them. In the remaining point, however, the Eastern trunk lines have the advantage. Not only will the traffic over the new line be much less, at least for some time, than over the Eastern trunk lines, but it will also be very largely in one direction unless this particular railroad is more successful in securing north-bound traffic than the other gulf roads. If no freight can be found for the cars going north, the traffic going south must pay the cost, not only of its own movement, but that of hauling back the empty cars as well. It must be admitted that the outlook for this road's securing a double haul is better than that of most, if not all, of the other railroads running north from the Gulf. The Port Arthur route passes through some of the best timber land on the continent, and it may therefore confidently expect a large north-bound traffic in ties and lumber. As it passes through two large coal fields, it may also hope to move large quantities of coal. Aside from these main items, the managers of this line expect to haul a portion of the imports consumed in the territory tributary to their railroad, and also hope to develop a considerable traffic in early fruits and vegetables.

But even supposing that the Port Arthur route can haul grain from Kansas City to the Gulf for less than the east-and-west roads can carry to the Atlantic seaboard, can this line develop a large export business? Are there not adverse circumstances which will fully counterbalance the advantage of a low rate to the Gulf? Will not higher ocean rates from the Gulf ports and the unfavorable climate of the Gulf region prevent the growth of the Southern export movement? In answer to the first of these questions, it may be said that ocean rates are less unfavorable from the Gulf ports now than they were formerly, and that as the amount of freight which is being offered to vessels is increasing, there will be more steamship lines to Southern ports and rates will be still further lowered. The second question seems to have been answered by the facts. The large amount of capital that has recently been invested in Southern terminals for handling grain by persons familiar with the climate and the immense movement of grain through Gulf ports during the year 1896 should be deemed sufficient proof that the climate of the Gulf does not rise as an obstacle to prevent the development of an export trade through the Gulf ports. However, the most circumspect persons make errors, and the experience of a single year does not afford a sufficient basis for a sound inference, so perhaps this point is not even now to be considered as definitively settled in the affirmative.

APPENDIX II.

TABLES RELATING TO THE FLOUR AND GRAIN TRAFFIC.

TABLE I.

Elevator charges at Chicago and Buffalo and lake freights on wheat from Chicago to Buffalo.

Year.	Elevator charges.			Lake freights, Chicago to Buffalo.
	Chicago wheat per bushel.*a*	Buffalo wheat per bushel.*b*	Chicago and Buffalo.	
	Cents.	*Cents.*	*Cents.*	*Cents.*
1870	.....	1.25	.....	5.88
1871	.....	1.25	.....	7.62
1872	2.00	1.25	3.25	11.46
1873	2.00	1.25	3.25	7.62
1874	2.00	1.25	3.25	4.03
1875	2.00	1.00	3.00	3.42
1876	2.00	1.00	3.00	2.90
1877	2.00	1.00	3.00	3.72
1878	1.25	1.00	2.25	3.07
1879	1.25	1.00	2.25	4.74
1880	1.25	1.00	2.25	5.76
1881	1.25	.875	2.125	3.44
1882	1.25	.875	2.125	2.50
1883	1.25	.875	2.125	3.41
1884	1.25	.875	2.125	2.18
1885	1.25	.875	2.125	2.02
1886	1.25	.875	2.125	3.68
1887	.75	.875	1.625	4.13
1888	.75	.875	1.625	2.56
1889	.75	.875	1.625	2.51
1890	.75	.875	1.625	1.96
1891	.75	.875	1.625	2.38
1892	.75	.875	1.625	2.19
1893	.75	.875	1.625	1.66
1894	.75	.875	1.625	1.27
1895	.75	.875	1.625	1.92
1896	.75	.875	1.625	1.63

a Published rates; from 10 to 20 days' storage included.
b Storage included; 5 to 10 days the limit.
A comparison of columns 4 and 5 shows that the elevator charges have not fallen so rapidly as the transportation rates; the former have therefore become an increasing burden.

TABLE II.

Elevating and storage rates at Buffalo.

[Internal Commerce, 1885, p. 489.]

Years.	Charge to grain.	Charge to vessels.	Number of days' storage.	Years.	Charge to grain.	Charge to vessels.	Number of days' storage.
	Cents.	*Cent.*			*Cents.*	*Cent.*	
1855 and 1856*a*	1½	¼	5	1872 and 1873*b*	*c*1	¼	5
1857 to 1860*a*	¾	¼	5	1874	1	¼	10
1861	⅝	¼	5	1875 and 1876*b*	*c*½ to ⅞	⅛	5
1862 to 1864	¾	¼	5	1877	⅞	⅛	5
1865 and 1866	1½	¼	10	1878*b*	¼ to ⅞	⅛	5
1867 and 1868	1½	¼	20	1879*b*	⅜ to ½	⅛	5
1869	1¼	¼	10	1880*b* and 1881	⅜ to ⅞	⅛	5
1870	1	¼	10	1882*b*	*d*½	⅛	5
1871	1	¼	5	1883 and 1884	¼	⅛	5

a Estimated. Elevators running wild greater part of the year. No records kept; figures obtained from old residents in the grain and vessel interests.
b Running wild part of the year.
c About.
d Average.

NOTES ON THE FOLLOWING TABLES.

The tables of shipments of flour and grain by lake from Chicago, compiled by George F. Stone, secretary of Chicago Board of Trade, are based upon the custom-house records; rail shipments are obtained directly from the railroads. In the case of Milwaukee, shipments by lake are also based upon the custom-house reports; shipments of flour and grain as given in the following tables are much less than they really were, for Milwaukee is used very largely as an intermediate port. Rail shipments from Milwaukee are furnished by the railroads. Receipts of flour and grain at Erie are based upon the custom-house records. Receipts of flour and grain at Buffalo are also based upon the custom-house records. The table of receipts at Buffalo was, however, submitted to P. G. Cook, secretary of the Western Elevating Association, and pronounced by him approximately correct for the years for which his association has records. The records of the association cover more than half the years of the table.

TABLE III.

East-bound shipments of flour and wheat from Chicago.

[Compiled from data furnished by George F. Stone, secretary of Chicago Board of Trade.]

Year.	Flour (barrels).			Wheat (bushels).		
	Lake.	Rail.	Total.	Lake.	Rail.	Total.
Year ending December 31—						
1860	218,741	408,082	626,823	11,817,476	377,647	12,195,123
1861	542,927	1,001,618	1,544,545	15,005,735	730,873	15,736,608
1862	1,057,803	672,961	1,730,764	13,466,325	175,322	13,641,647
1863						
Year ending March 31—						
1864	1,207,343	270,855	1,478,198	10,646,052	39,768	10,685,820
1865	1,034,793	208,747	1,243,540	9,983,567	114,075	10,097,642
1866	646,356	721,068	1,367,424	6,502,575	1,147,510	7,650,085
1867	481,491	1,585,776	2,067,267	5,827,846	3,605,618	9,433,464
1868	650,367	1,187,582	1,837,949	8,492,187	1,072,078	9,564,265
1869	774,556	1,749,973	2,524,529	8,896,647	2,114,300	11,010,947
Year ending December 31—						
1870	574,393	989,160	1,563,553	13,429,069	2,621,699	16,050,768
1871	488,705	694,274	1,182,979	12,120,923	576,648	12,697,571
1872	223,457	1,022,968	1,246,425	8,831,870	2,363,810	11,195,680
1873	428,321	1,773,467	2,201,788	15,528,984	8,149,209	23,678,193
1874	555,152	1,672,037	2,227,189	16,974,149	9,725,251	26,699,400
1875	328,283	1,872,943	2,201,226	16,061,054	5,956,609	22,017,663
1876	236,591	2,309,530	2,546,121	7,396,369	5,378,792	12,775,161
1877	148,779	2,229,729	2,378,508	10,345,983	2,957,250	13,303,233
1878	321,648	2,371,623	2,693,271	12,903,481	10,018,880	22,922,361
1879	330,257	2,675,402	3,005,659	17,622,796	12,232,323	29,855,119
1880	527,873	2,264,886	2,792,759	16,685,046	4,742,343	21,427,389
1881	159,415	4,235,559	4,394,974	7,688,072	7,728,124	15,416,196
1882	792,764	2,887,603	3,680,367	14,944,258	2,920,526	17,864,784
1883	801,099	3,067,275	3,868,374	7,067,657	2,696,071	9,763,728
1884	753,357	3,930,576	4,683,933	11,518,884	6,322,493	17,841,377
1885	652,373	4,450,051	5,102,424	5,436,461	5,496,544	10,933,005
1886	1,391,235	2,244,376	3,635,611	10,513,126	2,462,918	12,976,044
1887	1,544,196	4,682,546	6,226,742	17,313,351	6,893,504	24,206,855
1888	1,711,370	3,613,922	5,325,292	5,895,379	3,998,998	9,894,377
1889	1,811,467	1,951,274	3,762,741	10,330,675	4,814,978	15,145,653
1890	1,757,745	2,172,761	3,930,506	6,965,834	2,953,826	9,919,660
1891	1,640,738	2,244,280	3,885,018	31,102,888	5,470,333	36,573,221
1892	2,455,006	3,123,553	5,578,559	33,498,547	6,792,284	40,290,831
1893	1,471,060	2,493,206	3,964,266	19,720,775	2,618,327	22,339,102
1894	1,630,345	1,926,285	3,556,630	15,016,804	940,202	15,957,006
1895	791,620	1,597,495	2,389,115	13,258,440	5,666,997	18,925,437
1896	1,006,951	1,666,739	2,673,690	13,232,818	9,845,117	23,077,935
1897	1,060,734	1,557,342	2,618,076	18,449,628	5,511,774	23,961,402

East-bound shipments of corn and oats from Chicago.

[Compiled from data furnished by George F. Stone, secretary Chicago Board of Trade.]

Year.	Corn (bushels).			Oats (bushels).		
	Lake.	Rail.	Total.	Lake.	Rail.	Total.
Year ending December 31—						
1860	13,063,043	577,611	13,640,654	605,304	242,580	847,884
1861	23,987,240	352,044	24,339,284	1,422,776	69,731	1,492,507
1862	29,248,677	125,162	29,373,839	2,470,745	357,451	2,828,196
Year ending March 31—						
1864	24,749,400	120,694	24,870,094	5,696,800	2,213,058	7,909,858
1865	11,998,475	616,077	12,614,552	12,098,000	2,922,792	15,020,792
1866	24,421,600	674,053	25,095,653	8,719,900	1,538,383	10,258,283
1867	31,457,855	1,452,162	32,910,017	7,395,113	1,911,664	9,306,777
1868	19,940,172	1,612,851	21,553,023	9,745,205	388,114	10,133,319
1869	21,671,071	3,367,718	25,038,789	12,755,929	2,004,191	14,760,120
Year ending December 31—						
1870	13,598,387	4,018,479	17,616,866	6,339,220	2,064,333	8,403,553
1871	34,200,876	2,435,220	36,636,096	8,797,599	3,312,421	12,110,020
1872	41,589,508	5,388,402	46,977,910	6,370,784	5,853,319	12,224,103
1873	34,487,205	2,194,361	36,681,566	5,985,954	9,559,635	15,545,589
1874	30,242,311	2,364,833	32,607,144	4,741,088	5,674,137	10,415,225
1875	21,850,652	4,321,559	26,172,211	4,579,248	5,512,812	10,092,060
1876	28,104,265	17,299,232	45,403,497	2,997,335	8,166,155	11,163,490
1877	38,607,611	7,057,511	46,265,122	5,013,278	7,424,788	12,438,066
1878	46,368,653	13,504,458	59,873,111	6,255,003	10,149,386	16,404,389
1879	41,561,336	19,711,615	61,272,951	1,589,939	11,880,719	13,470,658
1880	72,400,769	21,100,849	93,501,618	2,139,473	18,402,996	20,542,469
1881	44,164,571	29,625,348	73,789,919	4,807,581	17,844,017	22,651,598
1882	31,394,261	16,965,706	48,359,967	3,633,638	18,966,513	22,600,151
1883	47,738,117	22,766,745	70,504,862	4,938,546	26,372,649	31,311,195
1884	27,360,924	24,526,517	51,887,441	5,444,889	27,780,317	33,225,206
1885	29,382,591	28,682,864	58,065,455	1,571,481	29,925,784	31,497,265
1886	40,956,177	13,903,051	54,859,228	3,219,833	27,756,005	30,975,838
1887	38,710,856	10,674,781	49,385,637	10,215,112	24,612,448	34,827,560
1888	47,759,708	20,520,599	68,280,307	13,764,336	25,761,204	39,525,540
1889	63,200,754	20,070,032	83,270,786	24,948,459	24,814,104	49,762,563
1890	57,255,466	31,834,558	89,090,024	18,522,884	50,604,575	69,127,459
1891	40,069,786	25,282,938	65,352,724	17,832,975	48,518,064	66,351,039
1892	43,920,570	19,900,596	63,821,166	19,127,515	44,567,510	63,695,025
1893	62,967,955	15,055,015	78,022,970	22,563,294	41,425,300	63,988,594
1894	37,148,719	16,171,144	53,319,863	13,913,761	32,719,788	46,633,549
1895	47,857,550	10,384,623	58,242,173	17,694,345	46,472,686	64,167,031
1896	74,379,206	12,063,390	86,442,596	23,798,409	55,992,549	79,790,958
1897	85,250,760	11,482,004	96,732,764	50,192,982	53,340,236	103,533,218

TABLE IV.

East-bound shipments of flour and wheat from Milwaukee.

[Prepared from data furnished by W. J. Langson, secretary of Milwaukee Chamber of Commerce.]

Year.	Flour (barrels).				Wheat (bushels).			
	Rail.	Transit lines.[a]	Lake.	Total.	Rail.	Transit lines.[a]	Lake.	Total.
1860	11,454	118,307	327,782	457,543	8,298	27,756	7,532,554	7,568,608
1861	76,371	224,632	373,471	674,474	98,780	.....	13,201,715	13,300,495
1862	10,183	260,947	440,275	711,405	6,773	.....	14,908,907	14,915,680
1863	3,439	127,468	472,619	603,526	1,756	.....	12,835,864	12,837,620
1864	5,265	52,251	357,317	414,833	3,712	8,169	8,980,598	8,992,479
1865	69,662	47,953	449,961	567,576	310,495	2,289	10,166,993	10,479,777
1866	242,681	83,812	393,872	720,365	695,188	63,170	10,876,391	11,634,749
1867	324,048	111,535	486,080	921,663	322,461	29,543	9,246,448	9,598,452
1868	359,721	104,882	552,995	1,017,598	455,810	10,401	9,411,888	9,878,099
1869	340,493	188,864	690,701	1,220,058	312,515	19,536	13,940,748	14,272,799
1870	233,540	209,201	783,200	1,225,941	282,061	79,752	15,766,025	16,127,838
1871	127,722	362,606	719,921	1,210,249	302,399	24,078	13,082,990	13,409,467
1872	306,076	421,757	507,168	1,235,001	785,557	168,043	10,616,975	11,570,575
1873	757,805	257,608	789,787	1,805,200	1,702,326	489,247	22,802,693	24,994,266
1874	854,584	330,271	1,032,724	2,217,579	3,172,165	1,193,786	17,889,429	22,255,380
1875	990,038	353,300	819,047	2,162,385	2,820,257	374,140	19,474,270	22,668,667
1876	1,289,147	719,268	643,977	2,652,392	2,265,374	1,751,211	12,754,987	16,771,572
1877	102,675	555,700	493,026	1,151,401	568,572	930,687	16,098,525	17,597,784
1878	170,084	533,439	734,543	1,438,066	1,937,110	2,330,795	10,510,017	14,777,922
1879	333,118	821,728	728,639	1,883,485	1,841,888	1,205,229	9,955,085	13,002,202
1880	230,415	859,666	938,575	2,028,656	1,021,490	286,462	7,025,959	8,333,911
1881	473,340	668,825	717,707	1,859,872	793,962	403,062	5,000,589	6,197,613
1882	218,241	971,369	1,540,549	2,730,159	174,110	189,548	825,576	1,189,234
1883	162,678	1,236,932	1,402,181	2,801,791	123,700	8,780	1,871,995	2,004,475
1884	200,398	1,272,860	1,581,997	3,055,205	1,446,663	66,209	2,083,817	3,296,689
1885	530,636	883,476	1,370,922	2,785,034	2,107,940	41,757	3,228,934	5,378,631
1886	153,609	1,495,500	2,344,673	3,993,782	507,695	4,146	4,205,470	4,717,311
1887	328,538	1,306,791	1,663,914	3,299,243	543,600	98,463	4,213,906	4,855,969
1888	413,418	1,167,660	1,820,123	3,401,201	682,490	35,115	1,759,508	2,477,113
1889	268,819	1,114,446	1,836,308	3,219,573	436,845	91,382	973,035	1,501,262
1890	196,389	1,379,389	1,613,728	3,189,504	203,875	122,395	1,389,714	1,715,984
1891	407,912	1,543,120	1,858,027	3,809,059	1,158,678	165,919	1,247,724	2,572,321
1892	467,728	1,525,035	2,312,673	4,305,436	1,299,699	454,101	1,833,994	3,587,794
1893	417,405	962,694	1,677,033	3,057,132	1,303,820	47,591	1,971,776	3,323,187
1894	336,525	928,000	1,889,686	3,154,211	224,850	13,565	231,227	469,642
1895	416,172	1,149,781	1,790,653	3,356,606	1,519,350	262,305	858,600	2,640,255
1896	410,710	2,164,016	1,975,165	4,549,891	1,084,900	370,350	797,873	2,253,123
1897	449,330	1,395,355	2,077,145	3,921,830	756,700	166,545	1,106,604	2,028,849

[a] "Transit lines" are the routes formed by vessels across Lake Michigan and railroads running to the east and southeast.

East-bound shipments of corn and oats from Milwaukee.

[Prepared from data furnished by W. J. Langson, secretary of Milwaukee Chamber of Commerce.]

Year.	Corn (bushels).				Oats (bushels).			
	Rail.	Transit lines. *a*	Lake.	Total.	Rail.	Transit lines. *a*	Lake.	Total.
1860	.....	2,257	34,947	37,204	4,599	11,704	48,379	64,682
1861	1,485	.....	.....	1,485	1,200	.....	.....	1,200
1862	9,489	.....	.....	9,489	3,173	.....	75,921	79,094
1863	.....	.....	88,989	88,989	14,089	.....	817,511	831,600
1864	.....	31,846	132,940	164,786	77,252	4,058	730,324	811,634
1865	1,195	35,657	34,351	71,203	.....	22,406	304,066	326,472
1866	.....	29,661	450,747	480,408	3,506	16,798	1,616,391	1,636,695
1867	630	69,299	196,320	266,249	13,724	51,178	557,567	622,469
1868	650	56,707	285,360	342,717	5,195	44,533	486,811	536,539
1869	2,106	42,579	49,121	93,806	10,490	29,350	311,928	351,768
1870	18,990	36,905	47,278	103,173	3,270	84,458	122,459	210,187
1871	1,261	26,774	391,128	419,163	10,524	47,458	714,947	772,929
1872	5,458	30,240	1,522,255	1,557,953	103,860	69,831	1,149,593	1,323,284
1873	2,508	740	194,672	197,920	144,742	3,630	842,153	990,525
1874	7,051	3,280	546,232	556,563	173,651	15,513	536,871	726,035
1875	32,440	8,583	185,872	226,895	450,186	6,868	703,396	1,160,450
1876	25,509	7,678	63,371	96,558	579,221	30,909	767,430	1,377,560
1877	21,034	18,943	246,830	286,807	291,225	22,285	464,666	778,176
1878	3,970	2,744	274,152	280,866	287,808	69,942	910,534	1,268,284
1879	5,884	1,854	805,998	813,736	232,718	7,286	806,664	1,046,668
1880	73,514	59,813	1,402,848	1,536,175	533,625	148,229	670,978	1,352,832
1881	28,818	69,903	255,613	354,334	390,977	135,042	373,870	899,889
1882	69,055	28,481	284,403	381,939	395,660	43,656	263,289	702,605
1883	108,200	18,298	1,364,375	1,490,873	253,000	18,566	1,633,849	1,905,415
1884	61,900	9,970	33,806	105,676	149,159	13,697	109,634	272,481
1885	36,000	.....	64,551	100,551	478,550	.....	87,554	566,104
1886	49,440	1,894	31,115	82,449	244,800	3,400	123,111	371,311
1887	73,840	9,735	26,687	110,262	258,205	2,150	154,011	414,366
1888	92,060	80,849	27,454	200,363	325,855	100,652	127,672	354,179
1889	43,680	73,350	51,231	168,261	344,000	188,616	212,020	744,636
1890	8,000	51,249	215,335	84,584	1,112,433	112,325	424,345	1,649,103
1891	59,640	103,132	64,253	227,025	948,000	371,736	632,537	1,952,273
1892	296,220	91,707	28,933	416,860	1,042,000	686,455	2,579,938	4,308,393
1893	172,290	21,860	7,200	201,350	562,000	1,578,913	3,520,869	5,666,782
1894	105,950	.....	3,217	109,167	300,000	1,133,042	4,732,963	6,166,005
1895	26,650	540	3,300	30,490	270,000	3,671,854	4,042,881	7,984,735
1896	77,600	.....	299,278	376,878	618,000	1,820,416	10,470,812	12,909,228
1897	139,300	17,300	1,719,981	1,876,581	926,000	1,965,168	5,993,138	8,884,306

a "Transit lines" are the routes formed by vessels across Lake Michigan and railroads running to the east and southeast.

TABLE V.

Receipts of flour and wheat at Erie and Buffalo by lake, and receipts at the leading eight Atlantic ports.

[,000 omitted.]

Year.	Flour (barrels).			Leading eight Atlantic ports.	Wheat (bushels).			Leading eight Atlantic ports.
	Erie. *a*	Buffalo. *b*	Total.		Erie. *a*	Buffalo. *b*	Total.	
1868	117	1,502	1,620	7,444	424	12,555	12,979	20,764
1869	156	1,598	1,754	8,427	672	19,228	19,901	38,633
1870	229	1,470	1,699	8,897	770	20,556	21,326	36,603
1871	167	1,278	1,445	8,618	731	22,606	23,338	43,527
1872	178	762	941	8,193	937	14,304	15,242	28,186
1873	216	1,259	1,475	9,260	2,511	30,618	33,130	52,614
1874	295	1,693	1,989	10,057	3,598	29,778	33,376	62,751
1875	320	1,810	2,131	9,411	3,132	32,967	36,099	54,457
1876	185	807	992	9,120	1,822	19,324	21,147	42,881
1877 *c*	85	693	778	8,334	2,507	23,284	25,791	46,828
1878 *c*	309	911	1,221	9,694	3,458	35,419	38,877	110,775
1879 *c*	368	897	1,265	11,291	3,244	37,788	41,032	144,264
1880 *c*	594	1,317	1,912	10,323	3,936	40,510	44,446	135,776
1881 *c*	492	1,051	1,543	10,558	2,029	18,495	20,524	85,843
1882 *c*	870	1,199	2,069	12,414	1,630	26,050	27,680	81,837
1883 *c*	810	2,071	2,882	13,429	649	24,105	24,754	58,836
1884	557	2,615	3,172	13,037	2,221	32,469	34,691	67,997
1885	568	2,903	3,471	13,352	514	27,130	27,645	46,076
1886	371	4,582	4,953	13,591	1,144	41,430	42,574	71,666
1887	919	4,001	4,920	15,602	1,500	48,111	49,611	83,177
1888	988	5,244	6,233	14,398	317	27,548	27,865	35,809
1889	1,655	5,480	7,136	13,611	1,125	26,051	27,177	30,015
1890	*d* 1,655	6,245	7,901	15,290	144	24,868	25,033	29,072
1891	990	7,093	8,093	17,040	6,803	76,945	83,748	102,489
1892	2,001	9,746	11,748	20,554	7,841	78,243	86,085	116,145
1893	1,704	10,562	12,266	21,378	3,334	68,243	71,578	86,052
1894	2,192	11,488	13,681	20,795	2,255	50,194	52,449	61,725
1895	1,918	8,971	10,889	19,271	1,777	47,256	49,033	49,205
1896	1,907	10,384	12,291	20,059	5,643	54,411	60,054	65,076
1897	.....	12,445	.....	.....	.....	56,566	.....	.....

a The receipts at Erie are those given in the annual reports of the New York Produce Exchange.

b The receipts at Buffalo are those given in "A sketch of the commerce, industries, and resources of Buffalo, 1883," by William Thurstone, secretary of the Buffalo Merchants' Exchange, in the annual reports of the New York Produce Exchange, and in the annual reports of the Buffalo Merchants' Exchange.

c Canadian receipts through the custom-house not included in 1877, 1878, 1879, 1880, 1881, 1882, and 1883 in the statements of Buffalo receipts.

d No separate record kept; estimated same as in 1889.

Receipts of corn and oats at Erie and Buffalo by lake, and receipts at the leading eight Atlantic ports.

[,000 omitted.]

Year.	Corn (bushels).			Leading eight Atlantic ports.	Oats (bushels).			Leading eight Atlantic ports.
	Erie. *a*	Buffalo. *b*	Total.		Erie. *a*	Buffalo. *b*	Total.	
1868	517	16,804	17,321	30,800	314	11,492	11,806	16,755
1869	637	11,549	12,186	20,315	130	5,459	5,589	15,259
1870	554	9,410	9,964	18,655	521	6,846	7,367	15,486
1871	301	26,110	26,412	46,417	42	9,006	9,048	21,015
1872	621	34,643	35,264	71,488	947	6,050	6,997	22,254
1873	1,344	28,550	29,895	49,322	351	5,972	6,323	22,270
1874	1,500	24,974	26,474	51,749	594	5,396	5,991	20,333
1875	859	22,593	23,452	46,929	187	8,494	8,682	19,070
1876	2,941	20,939	23,881	84,713	305	2,397	2,703	23,705
1877 *c*	3,022	33,362	36,385	82,716	32	4,279	4,301	19,243
1878 *c*	3,195	35,133	38,329	97,306	137	5,122	5,260	23,842
1879 *c*	2,119	32,990	35,110	94,680	279	1,104	1,384	20,786
1880 *c*	7,070	62,214	69,284	115,410	5	1,649	1,654	23,714
1881 *c*	4,667	34,434	39,102	84,983	511	3,565	4,076	24,738
1882 *c*	2,578	21,664	24,243	28,402	547	1,650	2,197	25,464
1883 *c*	3,140	34,975	38,115	62,764	275	3,226	3,502	30,040
1884	1,263	18,538	19,801	39,555	19	3,174	3,194	31,525
1885	1,647	21,028	22,675	77,440	5	767	772	40,412
1886	1,479	29,155	30,634	67,585	.....	1,014	1,014	35,917
1887	354	30,199	30,554	43,614	.....	4,656	4,656	35,449
1888	1,636	36,422	38,058	47,799	68	7,897	7,965	40,052
1889	3,522	47,127	50,649	83,149	551	14,309	14,861	38,415
1890	7,225	44,136	51,362	92,444	5	13,860	13,865	52,310
1891	2,231	29,616	31,847	50,949	183	12,454	12,637	45,563
1892	5,595	32,377	37,973	33,838	.....	16,500	16,500	56,453
1893	8,009	40,539	48,549	59,802	361	20,700	21,061	52,495
1894	2,651	29,078	31,730	53,546	5	15,560	15,565	44,940
1895	2,759	37,579	40,339	66,933	50	22,231	22,281	45,109
1896	6,843	47,811	54,654	113,456	384	40,107	40,492	78,919
1897	.....	56,933	.....	.....	.....	64,141	.....	.....

a The receipts at Erie are those given in the annual reports of the New York Produce Exchange.

b The receipts at Buffalo are those given in "A sketch of the commerce, industries, and resources of Buffalo, 1883," by William Thurstone, secretary of the Buffalo Merchants' Exchange, in the annual reports of the New York Produce Exchange, and in the annual reports of the Buffalo Merchants' Exchange.

c Canadian receipts through the custom-house not included in 1877, 1878, 1879, 1880, 1881, 1882, and 1883 in the statements of Buffalo receipts.

TABLE VI.

Exports of flour and wheat from New Orleans and Galveston. (a)

[,000 omitted.]

Year.	Flour (barrels).			Wheat (bushels).		
	New Orleans.	Galveston.	Total.	New Orleans.	Galveston.	Total.
1880	52	0	52	3,923	0	3,923
1881	64	2	66	7,671	0	7,671
1882	28	0	28	1,543	0	1,543
1883	84	0	84	7,089	3	7,092
1884	33	0	33	648	27	675
1885	25	0	25	1,590	2	1,592
1887	54	4	58	4,346	0	4,346
1888	43	0	43	1,566	0	1,566
1889	32	0	32	961	0	961
1890	44	19	63	1,523	.....	1,523
1891	52	12	64	10,336	587	10,923
1892	226	21	247	14,207	378	14,585
1893	118	51	169	12,897	1,311	13,208
1894	133	59	192	2,926	135	3,061
1895	91	53	144	836	.....	836
1896	268	58	326	3,853	3,439	7,292

a For 1880 to 1890 the figures were obtained from Commerce and Navigation of United States, and for 1889 to 1896 from the annual reports of the New York Produce Exchange. The exports were taken instead of the receipts, because the former alone could be competitive traffic.

Exports of corn and oats from New Orleans and Galveston.

Year.	Corn (bushels).			Oats (bushels).		
	New Orleans.	Galveston.	Total.	New Orleans.	Galveston.	Total.
1880	8,039	0	8,039	4	0	4
1881	8,900	0	8,900	2	0	2
1882	1,740	0	1,740	3	0	3
1883	6,378	3	6,381	8	0	8
1884	6,052	0	6,052	3	0	3
1885	6,645	0	6,645	4	0	4
1887	7,506	0	7,506	2	5	7
1888	4,950	0	4,950	1	0	1
1889	11,813	0	11,813	0	0	0
1890	12,028	36	12,064	26	1	27
1891	1,912	13	1,925	2	.....	2
1892	7,379	145	7,524	9	.....	9
1893	6,506	98	6,604	123	13	136
1894	5,441	5	5,446	13	18	31
1895	8,757	1,233	8,990	24	.....	24
1896	25,293	6,222	31,515	262	.....	262

PART III.

LAKE TRANSPORTATION AND THE IRON-ORE INDUSTRY.

In examining the traffic statistics of the Great Lakes our attention is at once arrested by the enormous amount of iron ore that is annually transported. During the navigation season of 1897, of the 18,982,755 net tons of freight sent through the St. Marys Falls Canal, 10,633,715 net tons were iron ore; the total shipments of iron ore by lake from all the lake ports aggregated 13,681,522 net tons. At present, approximately, two-thirds of the iron ore consumed by the blast furnaces of this country is carried, during some portion of the journey from the mine to the furnace, over the waters of the Great Lakes. That this vast amount of ore from the Lake Superior region has affected the mining operations of the other ore-producing districts and has had a far-reaching effect upon the development of our iron and steel industries is a matter of general information. It may be of interest to point out the extent to which the exploitation of the mines in other portions of the United States has been effected by the output from the mines of the Lake Superior region.

Before developing the point just raised, it will be well, perhaps, to locate in a general way the regions in which large quantities of ore are now being mined. Iron ore is very widely distributed throughout the United States. With possibly three exceptions every State and Territory in the Union has mined iron ore or contains deposits. But at present nearly the whole product is won from the mines of three districts.

The Eastern region, and naturally the first to be noticed, covers a great extent of territory; but the mines of New York, New Jersey, Pennsylvania, and Ohio have contributed nearly the whole output of this division. Within its borders all four of the varieties[1] of ore are mined.

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[1] For the sake of simplicity I shall use the classification of ores adopted by the United States Geological Survey, as follows: (1) Red hematite comprises those ores in which the iron occurs as an anhydrous oxide, giving a red streak on a porcelain plate, the color of the ore being generally a brownish-red or red, although sometimes a dark gray, almost black. This class includes "red hematite," "fossil," or "Clinton" ores, "specular," "micaceous" ore, "slate" ore, etc., as well as some "martite." (2) Brown hematite, which contains more water than the red hematite, is generally of a brown or yellow color, and when powdered shows a brown or brownish-yellow streak on the porcelain plate. The varieties are known as "limonite," "turgite," "pipe" ore, "bog" ore, "goethite," "oolitic" ore, etc. (3) Magnetite comprises those ores in which iron occurs as a magnetic oxide, generally black or blueblack, or occasionally steel gray or greenish in color, and which when powdered give a black streak on a test plate, and are attracted by a magnet. In this class is included some "martite," which is mined with magnetite. (4) Carbonate includes those iron ores which contain an excess of carbonic acid. They are generally gray, yellow, or rather buff and brown in color, and are tested by the use of hydrochloric acid. They comprise the "black band" ores, "clay ironstones," "spathic" ores, "siderites," etc.

From some mines, brown and red hematite, or red hematite and magnetite, or carbonate and brown hematite ores are obtained out of the same workings, the extent to which ores are hydrated or weathered transferring them from one class to another; or different classes of ore are found intermixed or alternating in the same deposit. (John Birkinbine, The Production of Iron Ore in Various parts of the World, p. 177.)

Pennsylvania is rich in all of the four different kinds of ore, but they seldom contain as high a percentage of iron as is now insisted upon by managers of blast furnaces. The bulk of Pennsylvania's product is now of the magnetite variety. This is largely taken from the Cornwall Ore Hills, three hills of iron ore situated in Lebanon County in the southeastern part of the State. This ore is suited to the manufacture of Bessemer steel, but is rather low in metallic iron, as it averages but 40 to 50 per cent. New York also produces the four different varieties of ore, but at present the bulk of the product is magnetite in character and is mined in the Lake Champlain district. Most of this ore is rich in metallic iron and some of it is of Bessemer quality. Very near the whole of the output of the mines of New Jersey is of the magnetite variety, and much of it is of excellent quality. Many mines of this State are now practically exhausted and others are operated only at increasing cost because of the depth to which the ore has been removed and the narrowness of the veins.[1] The ores of Ohio are carbonates and are comparatively poor.

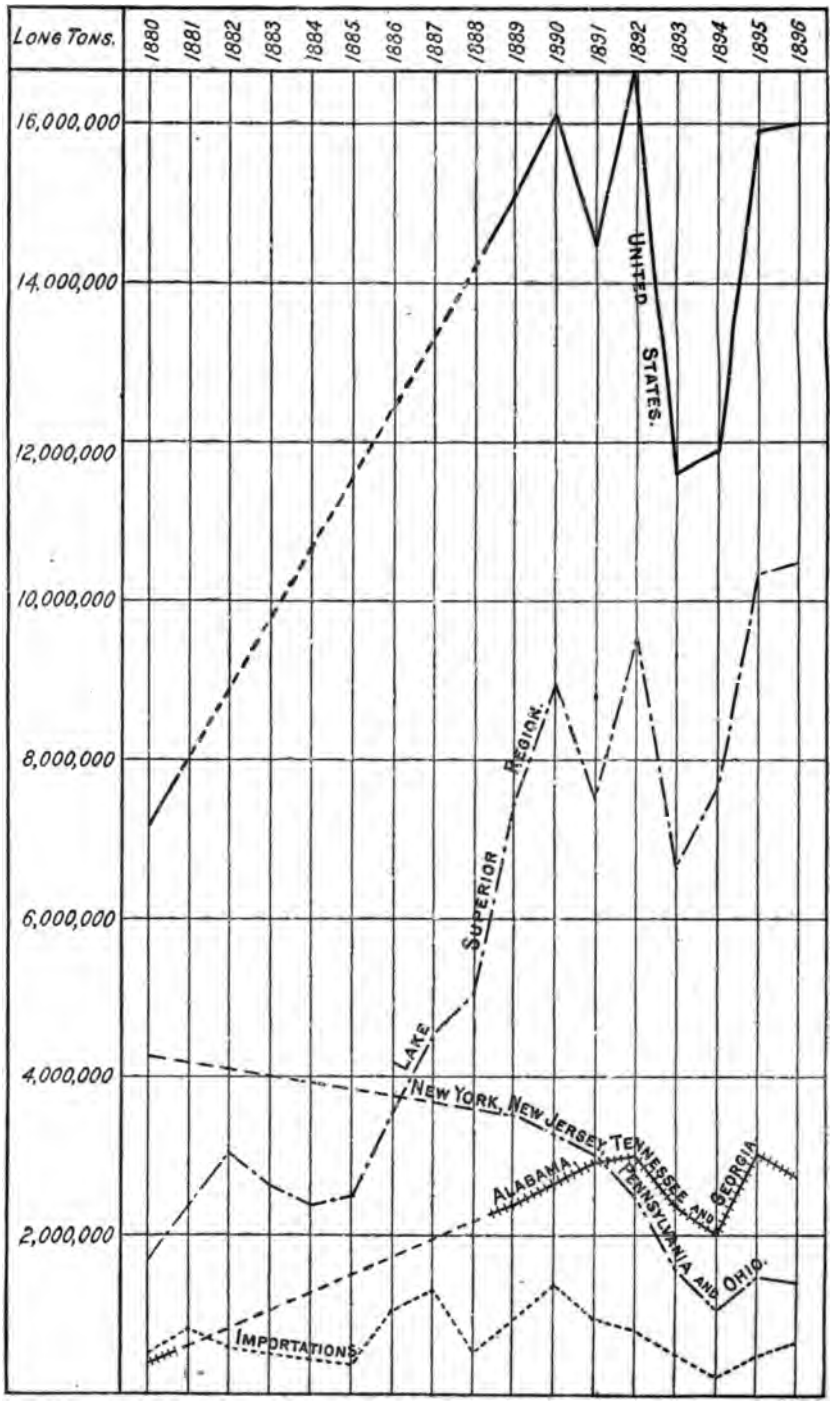
The Lake Superior region, unlike the Eastern region, embraces but a small extent of territory. It falls within the northern portions of the States of Wisconsin and Minnesota and the Upper Peninsula of Michigan. There are five great iron-ore ranges within this district, Marquette, Gogebic, Menominee, Vermilion, and Mesabi. The Marquette range is located in Michigan; the Gogebic and Menominee are partly in Michigan and partly in Wisconsin, and the Vermilion and Mesabi lie wholly within the State of Minnesota. The ores of this region are red and brown hematites and magnetites, but the bulk of the ore now shipped is of the red hematite variety. Only the richer ores are now shipped, as most of the blast furnaces using Lake Superior ores are situated at great distances from the mines.

The third great ore region is located in the South, and embraces the central portion of Tennessee, the northern part of Alabama, and northwestern Georgia. It is generally known as the Alabama-Tennessee region. This division ranks next in importance to the Lake Superior district as a contributor to the iron-ore output of the United States. Nearly all the ore now mined in this region is red and brown hematite. It is neither so rich in metallic iron nor so free from deleterious ingredients as are the Lake Superior ores.

It was stated at the beginning that the very large movement of ore from the Lake Superior region has affected mining operations in the other districts. In order to show the amount of ore contributed by the various regions to the total for the United States in a form easily comprehensible, and also in order more clearly to present the comparative development of the different districts, the figures covering the production of iron ore in the several regions, and in the United States as a whole, have been put into the form of a chart. As reliable and complete data are not obtainable, it has not been attempted to make the chart cover the years previous to 1880.[2] As the changes which it is desired to point out have for the most part taken place since 1880, the absence

[1] Under the leadership of Thomas A. Edison, a company has been organized and a large plant erected for enriching the lean magnetic ores of New Jersey. The results of this enterprise will probably disappoint the investors. For a description of this undertaking see Iron Age, Vol. LX, No. 18, p. 1, and McClure's Magazine, November, 1897.

[2] For the census year 1870, the facts are given in Appendix III, Table II, and it is also there explained in what respect the figures of that census are faulty. The items which were combined to form totals that appear in the chart are given in greater detail in the same place.


LONG TONS.
1880
1881
1882
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1889
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1891
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1894
1895
1896
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
UNITED STATES.
LAKE SUPERIOR REGION.
NEW YORK, NEW JERSEY, PENNSYLVANIA AND OHIO.
TENNESSEE AND GEORGIA
ALABAMA.
IMPORTATIONS.

of statistics for the earlier years is a matter of but little concern. But the meagerness of information concerning the production of iron ore during the decade beginning with the year 1880 is cause for regret, for it was during this period that the greatest changes occurred in the relative importance of the ore regions. It will be noted that during the first ten years there is perfect uniformity of movement in the lines which represent the total production for the United States, and those for the Eastern and Southern divisions. These lines do not accurately reflect actual conditions—the statistics that show the production during the years intervening between 1880 and 1889 are not obtainable. Such facts as can be obtained are given in Appendix III, Table II.

That the importance of the Lake Superior region can not easily be overestimated is made clear by the chart; from a comparatively unimportant position it has, in the course of a decade and a half, come to contribute almost twice as much ore as all the other parts of the United States combined. In the census year 1880 the total production for the United States was 7,120,362 long tons; to this amount the lake region contributed but 1,677,814 tons, or 23.6 per cent of the total output. During the year 1896 16,005,449 long tons of ore were mined in the United States, and of this amount 10,566,359 tons, or 66 per cent, were taken from the mines of the lake region. The bare figures without further explanations do not, however, fully reflect the importance of the northern district, for Lake Superior ores are very much richer in iron than the ores of the other regions. If the quality as well as the quantity of the ore be taken into consideration, the lake region is entitled to even a more important position than would be assigned to it on a simple tonnage basis of comparison.

In striking contrast with the increased production of the lake region is the rapid decrease in the amount contributed by the great mining States of the eastern region. During the census year 1880 the mines of New York, Pennsylvania, New Jersey, and Ohio yielded 4,243,372 long tons of ore, the total product of the United States being but 7,120,362 tons. The production of these States fell off slowly in the years following 1880, but after 1889 the decrease was rapid and continuous until 1895, when there was a break in the downward movement. The share of these four States in the total output of 16,005,449 long tons for 1896 was but 1,456,740 tons. Expressed in percentages, there was raised from the mines of these States during the census year 1880 59.59 per cent of the total product of the mines of the United States, and in 1896 but 9.10 per cent—an enormous falling off. This very great contraction[1] of the product of New York, Pennsylvania, New Jersey, and Ohio is the more surprising because most of the blast furnaces of the United States are located within their boundaries.

The output of the southern district has largely increased during the period covered by the chart, but the progress of this region has been much slower than that of the lake division. The southern district is in large measure isolated; its ores are not thrown into direct competition with the lake ores, as is the case with the eastern ores, for transportation charges act as a barrier and prevent such competition. The

[1] The ores of the eastern region must also meet the competition of foreign ores. There has been, however, no large increase in importations, hence the decreased output of the eastern region can not in any appreciable measure be ascribed to foreign competition. During the past few years there has been a decrease of importations. It is therefore very clear that the excessive competition of imported ores does not explain the limited output of the eastern mines. Beginning with the year 1872 the importations will be found in Appendix III, Table II; they are also represented by the lowest line of the chart for the years which it covers.

extent of the substitution of lake ores for eastern ores is shown by the chart (p. 62). It yet remains to be shown why the former ores are preferred to the latter, and how it is possible to carry ores from the mines of Minnesota to the furnaces of Pennsylvania and sell them at such a price that they will be taken in preference to native ores. Lake Superior ores are now transported almost to the Atlantic Seaboard[1] and there sold in competition with both native and foreign ores.[2] That lake ores have qualities which commend them to ironmasters is obvious. The high esteem in which they are held is due partly to their great richness in metallic iron, largely to their freedom from deleterious ingredients, particularly phosphorus and sulphur, and to some extent to their excellent physical condition and freedom from moisture.

All of these factors weigh in determining the value of an iron ore. In general a rich ore requires less fuel to smelt it; it also has less foreign matter to be fluxed out, and thus a smaller amount of limestone will suffice for fluxing. If a rich ore be used there is therefore a threefold saving: (1) Because an ore rich in metallic iron generally reduces more readily than a lean ore; (2) as less limestone is necessary, a smaller amount of fuel will be needed to smelt the flux, and (3) there is a saving of fluxing material which, in the case of a large establishment, amounts to a considerable sum in the course of a year. With rich ores, as less flux and fuel are required, the labor cost of handling the raw materials is smaller, and as less cinder is made, the expense of providing space for this cinder and means for handling it is consequently reduced. The richer ores, together with the proper quantities of fuel and flux, occupy less space in the blast furnace than the leaner ores combined with the fuel and flux required to reduce them, and therefore generally permit of more rapid "driving." In the case of the richer ores there is, therefore, a smaller cost per ton of product, for interest on the plant, management, and other fixed charges, because these expenses are distributed over a greater tonnage than would be the case if lean ores were used.

Other things being equal, the smaller the amount of phosphorus sulphur and titanic acid and other undesirable substances[3] which the ore contains, the greater will be its value. If an ore contains more than one part phosphorus[4] to every one thousand parts metallic iron, it is unfit for the manufacture of steel by what is now the cheapest method—

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[1] The blast furnaces in New Jersey and eastern Pennsylvania receive a portion of their supply of ore from the Lake Superior region. (See Eleventh Census: Mineral Industries, p. 26; and The Production of Iron Ores in Various Parts of the World, p. 188.)

[2] The ability of foreign ores to compete is of course affected by the import duties paid. Previous to August 28, 1894, the duty was 75 cents per ton, and under the tariff act of 1894 it was 40 cents; in the tariff act of 1897 the rate appears unchanged.

[3] "As won from the earth iron ores carry in greater or less proportions other elements, such as phosphorus, sulphur, manganese, titanium, chromium, copper, etc., which affect their value for specific uses, as do also the amounts of silica, lime, alumina, magnesia, etc.; these latter, however, generally influence the percentage of metal obtainable from the ore, while the first named, as a rule, are more likely to affect its quality." (John Birkinbine, The Manufacture of Pig Iron in Pennsylvania, p. 2.)

It should not be understood that these substances are always injurious, for such is not the case. For instance, if the iron produced is to be used for foundry purposes, silica is not harmful if great strength is not desired; in fact, quite the contrary is true, for the silica gives the iron greater fluidity, thus making it a better casting iron.

[4] There is now a tendency to insist on a still lower percentage of phosphorus; late specifications for steel rails do not accept 0.1 of 1 per cent phosphorus, but demand 0.085 of 1 per cent phosphorus. Specifications for structural steel also insist upon less phosphorus than formerly.

the original or acid Bessemer process. This is a very damaging disqualification, for at present the owners of the Bessemer steel works are the largest purchasers[1] of iron ore, and pay the highest prices.

Yet another important condition is to be added; not only must the amount of phosphorus in the ore be small, but it must be uniformly distributed; otherwise, in case the Bessemer converter be used, the steel manufactured from the ore will vary in quality with every discharge of the blast furnace.[2] This is the case, because practically all of the phosphorus in the ore goes into the pig iron, and is not removed from it by the ordinary Bessemer converter. To make the matter perfectly clear an illustration may be given. Suppose that the quantity of phosphorus in the ore as it comes from the mine shows rather large variations, but that the average of phosphorus falls below the Bessemer limit. Also suppose that the charges of the furnace to which the ore is brought vary in the amount of phosphorus they contain, some being very low and others very high in phosphorus content. Such being the case, the steel produced from the iron resulting from the charges very low in phosphorus will contain but little of this element, the steel from the charges high in phosphorus will contain a very large amount, and it will, therefore, be unfit for the higher uses to which the steel is put. This difficulty can, in a measure, be obviated by frequently testing the ore and then mixing it in proper proportions, but this involves expense.

Favorable physical texture and freedom from moisture, the two remaining characteristics of first-class ore, are also important considerations. If ore be very hard and dense, and if it be introduced in large masses, it is not readily penetrated by the reducing gases of the furnace. Hard ores, therefore, require more fuel and care to smelt them. To break hard ores with a sledge, as was formerly done, was very slow and heavy work. Manual labor has now been superseded by heavy machines, which crush the ore at slight expense, and thus the objections that once weighed against the hard ores have lost much of their force. Finely divided ores are also difficult to reduce. They pack and form such impenetrable masses in the furnace that they are acted upon very slowly by the gases. The very finely comminuted ores are also blown out of the furnaces in large quantities by the strong blasts that are now used, and in some cases these ores have caused serious explosions. Moisture is objectionable for two reasons: It increases the weight of the ore and therefore the freight, and in general there is at every point

[1] The extent and growing importance of the demand for Bessemer ores is indicated by the following percentages, which give the proportion of Bessemer pig iron to the total pig-iron product of the United States:

	Per cent.		Per cent.		Per cent.
1889	41.4	1892	48.5	1895	59.5
1890	44.5	1893	50.9	1896	53.9
1891	41.9	1894	57.2		

"As some iron ores not within the Bessemer limit of phosphorus were used in admixture with low phosphorus ores in the production of Bessemer pig iron, and as many of the ores used for producing foundry and mill irons carry lower percentages of metal than those smelted in the production of Bessemer pig iron, the proportion of Bessemer ore will not be so great as that shown for the pig metal, but the percentages are sufficiently close to indicate the growing increase in the employment of such material." (John Birkinbine, Production of Iron Ores in 1895, p. 8.)

The percentage for 1896 was deduced from the statistics of production as given in the Bulletin of American Iron and Steel Association, Vol. XXXI, No. 3, p. 21.

[2] For the information of those who are unacquainted with the manufacture of steel it may be stated that the iron ore is reduced to metal in the blast furnace, and then placed in the Bessemer converter and changed to steel.

a profitless expenditure of energy in handling it. It also requires heat to expel it from the blast furnace, which means an increased consumption of fuel.

As was stated above, the lake ores find favor with ironmasters, because they possess in a very high degree the four essential qualities of a good iron ore. That a definite conception of the relative standing of the ores of the various districts may be formed, the results of the best analyses we have will be submitted. The results of the very numerous analyses made by Prof. Raphael Pumpelly of the ores mined in the census year 1880 will first be given. In some localities the character of the ore mined has changed considerably since his examinations were made. For these localities the necessary corrections will be made so as to show existing conditions. The following is a portion of Professor Pumpelly's table showing the average per cent of metallic iron in the ore mined during the census year 1880:[1]

Eastern region:	
New York	53.99
New Jersey	53.73
Pennsylvania	45.28
Ohio	38.62
Southern region:	
Alabama	50.67
Tennessee	50.59
Georgia	51.37
Lake Superior region:	
Michigan	59.57
Minnesota	[2]
Wisconsin	[3]52.56

There has been no great change in the iron contents of the ores mined in the eastern region, yet some of the best deposits have been exhausted. Hence, if a test were now made, the ores of this district would not appear in so favorable a light as they did in 1880. It is being found necessary to an increasing extent to improve ores by washing, jigging,[4] and by the use of magnetic separators.

There has been even a greater change since 1880 in the quality of the Southern ores. The average yield of the ores used by the blast furnaces of Alabama during the last census year was 44.4 per cent.[5] The Clinton fossil ores (red hematite), which now constitute the bulk of the ore mined in this district, yield on an average from 42 to 47 per cent of metallic iron. The Southern brown hematites are not so good as the Clinton ores; if properly washed, however, they yield from 45 to 50 per cent of iron.[6]

The lake ores are somewhat better in quality than those mined in 1880. In the opinion of David T. Day, special agent on the mineral resources of the United States for the Eleventh Census, the ores which were shipped to distant furnaces contained on the average 60 per cent of metallic iron. The ores which were consumed in furnaces near at hand averaged 58 per cent of iron; but as these were relatively unimportant, the average of 60 per cent was not much reduced. Since Mr.

[1] Tenth Census: Mining Industries, p. 19. The census year began June 1, 1879, and ended May 31, 1880.

[2] Minnesota did not become a producer of iron ore until the year 1884.

[3] Wisconsin's mining operations were wholly carried on in a different part of the State from where they now are, so that the figures for this State are quite meaningless.

[4] In jigging, the crushed ore is agitated in a jigger, water being introduced for the removal from the ore of sand, clay, and earthy matter.

[5] Eleventh Census: Mineral Industries, p. 11.

[6] The Production of Iron Ores in Various Parts of the World, p. 23.

Day made his report the output of the Vermilion range has been appreciably increased, and the Mesabi has suddenly sprung into prominence as a producer of iron ore. The latter now holds first place among the ranges. As the ores which are shipped from these ranges are richer in iron than those of the older ranges, the census figures are now, perhaps, a trifle too low. Mr. Franklin H. Head, an authority on the ores of the lake district, supports me on this point. In a recent letter he says: "I think a fair average of the ores shipped would yield in the furnace 62 tons of iron to each 100 tons of ore."

Unfortunately, it is impossible to give equally exact information concerning the impurities in the ores of the several districts as has been given of the iron contents. Perhaps less than one-fourth of the ore of the Eastern district can be classed as Bessemer; much of it contains large amounts of sulphur, and some of it carries a small amount of copper, and some of it has considerable quantities of titanium. The ore of the great Cornwall deposits contains on the average about 2.5 per cent of sulphur, and requires preliminary roasting in kilns to drive off a portion of this and an excess of lime in the blast furnace to eliminate the balance. About one-half of the sulphur is removed by the roasting, which costs about 20 cents per ton for fuel and handling. This ore also contains a small amount of copper, but still large enough to be troublesome in some subsequent metallurgical processes. Many of the ores of New York contain titanium. In reducing these ores, greater care must be exercised in fluxing. The furnace must also be run under special conditions of temperature and pressure of blast, otherwise titanium deposits will form in the furnace. This special condition of lower heat, considered more favorable to the smelting of these ores, requires more fuel. These disadvantages have prejudiced furnace managers against ores containing titanium.

In many cases the physical condition of the eastern ores is against them. The magnetites of New York and New Jersey are very refractory; they are not easily penetrated by the reducing gases of the furnace, because of their great density. Furnace managers assert that they require more fuel and care to smelt them, and therefore, other things being equal, they prefer the softer hematites of the lake region. It is no longer found profitable to mine carbonate ores, for they must be roasted to drive off carbonic acid before they can be charged into the furnace. The cost of mining is also excessive, as they generally occur in thin seams or in scattered deposits.

The southern ores are non-Bessemer in quality; they are either too high in phosphorus, or else this element is very unequally distributed. An exception to this statement is the Cranberry ore of western North Carolina. Other ores of the same general characteristics are thought to exist in the same part of the State and in Roan Mountain, of eastern Tennessee, and possibly in the northwestern part of South Carolina. With these exceptions no extensive deposits of low-phosphorus ores are known in any southern State. The southern ores generally contain considerable quantities of sulphur, and the percentage of silica and lime varies greatly.

Most of the ores of the lake region are low in phosphorus, and thus the larger portion of them is of Bessemer quality. The percentage of Bessemer ores for the whole lake region is depressed by the contributions of the Menominee range, which produces mainly non-Bessemer ores. The lake ores are very free from sulphur, and generally contain no titanic acid. Furnace managers have experienced difficulty with Mesabi ores because of their finely comminuted state; but this trouble

may be considered as temporary in character, for the blast-furnace managers may be relied upon to modify their furnaces and methods in such a manner as will enable them to use the large and valuable deposits of this range. However, it must be said that, after four years of experimentation, in which large sums of money have been spent, furnace masters are unable to use more than about 45 per cent of Mesabi ore in their principal mixtures. Some of the lake ores carry considerable moisture, and the average amount of water in the ores mined in the lake region is greater than in the ores of the eastern district and about equal to that in the ores of the southern region.[1]

It has been seen to what extent the lake ores have supplanted the eastern ores. I have also shown why the lake ores are preferred by the ironmasters of the East to the ores mined nearer to their furnaces. Among the reasons for this preference are also found the facts which make it desirable to move the ore. There then remains to explain the peculiar combination of conditions which renders it possible to mine and transport these ores almost half way across the continent and yet sell them at such prices that they are taken in preference to the native ores.

It is obvious that in order to be available the ore must be found in favorable conditions; it usually occurs in large deposits rather than in narrow and irregular veins of varying depth. As a result it can be more cheaply mined, for labor-saving machinery can be used, and there is also much less waste material to be handled. The great extent of the deposits permits large production and its incidental economies. The steam shovel is an example in point; it is employed to dig and load ore from open cuts and to load ore on cars from stock piles. During one day in the summer of 1896 three steam shovels, working fourteen hours each, dug and raised from the natural bed of the Oliver mine of the Mesabi range 10,700 gross tons or 428 cars of ore. Twenty-five-ton ore cars have been continuously loaded from the ore bed at the rate of two and one-half minutes per car; the largest shovel[2] has loaded as much as 5,825 tons, or 233 cars in a day of 10 hours.

It is estimated that the average cost of loading the ore into cars from the bed of this mine is considerably less than five cents per ton. Before the shovel could be put to work on the ore it was necessary to remove a considerable amount of drift; but this expense, if averaged on all the

[1] An accurate conception of the character of some of the ores of the Lake Superior region can be obtained from the subjoined table, which contains complete analyses of cargo samples of grades of ore taken from some of the largest producing mines of this region:

[The Iron Mines of Minnesota, prepared for the seventy-third meeting of the American Institute of Mining Engineers.]

Name of mine.	Range.	Iron.	Silica.	Phosphorus.	Manganese.	Sulphur.	Alum.	Lime.	Magnesium.	Moisture.
Minnesota	Vermilion	67.74	1.55	0.048	None.	None.	0.90	0.27	0.12	2.00
Chandler	do	64.70	4.26	.036	0.13	Trace.	1.37	.33	.10	5.79
Burt	Mesabi	65.48	3.17	.034	.49	0.006	1.43	.56	.20	8.97
Oliver	do	63.31	4.53	.053	.51	.010	2.10	.20	.047	9.07
Lake Superior No. 1	Marquette	65.00	3.40	.100	.23	.013	2.10	.26	.024	1.15
Pewabic	Menominee	64.36	3.85	.009	.19	.003	.48	1.10	1.35	6.46
Norrie	Gogebic	63.18	3.62	.041	.34	.017	1.74	.19	.13	9.86

[2] This shovel is mounted on extra heavy railroad car trucks of standard gauge. It weighs 90 tons, has hoisting engines of 200 horsepower, and is equipped with a dipper having a capacity of 2½ cubic yards, and will load five or six tons at each swing.

ore which can be secured from the mine, would not exceed 5 cents per ton, and in all probability would be much less. The cost of stripping and of raising the ore practically represents the cost of mining this deposit, and these items combined aggregate less than 10 cents per gross ton.[1]

Specialized transportation facilities have been a most important factor in enabling the ore of the Lake Superior region to compete at distant points. Several ore roads[2] equipped with cars designed for the ore traffic have been constructed,[3] and expensive terminals have been built. At the shipping ports these consist of docks built as high as 57⅔ feet above the water, and so constructed that the ore trains can be run out upon them.[4] The docks are equipped with pockets having a capacity of from 65 to 186 tons, into which the ore is unloaded from the cars by means of drop bottoms. From the pockets of the dock the ore falls through iron chutes into the holds of the vessels, which are run up alongside of the dock.

By these appliances handling of the ore is avoided from the time the ore leaves the mines until it reaches the receiving port, where it is shoveled into buckets lowered into the ship's hold. Very little manual labor is required in these operations. It is necessary to start the ore by jamming it with crowbars at the opening of the pocket into the chute, and it is also necessary to push it occasionally with poles, but upon the whole the ore moves down by force of gravity alone. In the hold of the vessel the ore is generally trimmed. For this there is charged 2½ cents per gross ton.

The ore-receiving docks at the lower lake ports are equally well fitted for the work they perform. They are equipped with machinery well adapted to the rapid removal of the ore from the holds of the vessels at a very small cost. The outlay for shoveling the ore into buckets, which are lowered into the holds of vessels, is the chief item. It is now 9 cents per long ton, being done by manual labor. In addition to this there is the dock charge of 5 cents, which makes the total expense of discharging ore 14 cents per gross ton. With the improved equipment of some of the docks, the ore in buckets is raised from the hold, carried back 350 feet on the dock, and dumped at a total cost (including labor, depreciation of plant, interest, and fuel) of from 1 to 1½ cents per ton. Most of the ore, instead of being dumped on the stock pile, is now loaded

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[1] From the Iron Age, Vol. LVIII, No. 16, p. 725.

[2] The iron-ore mines of each of the five ranges constituting the lake region are situated some distance from the lakes. The nearest mines of the Marquette range are 12 miles from a shipping port; none of the mines of the Menominee range are less than 41 miles from a shipping port. The Gogebic range is about 10 miles from the lake, but the nearest shipping point is 39 miles distant. The mines of the Minnesota ranges are still farther removed from the lake, the Tower Mines of the Vermilion range being 69 miles from the shipping port of Two Harbors, and those at Ely about 20 miles farther removed. The ores of the Mesabi are carried about the same distances as those of the Vermilion range. Two Harbors and Duluth, Minn., and Superior, Wis., are the shipping ports of this range.

[3] For the transportation of the ores of Minnesota, over 400 miles of standard-gauge railroad have been constructed through what was a trackless wilderness ten years ago. For a statement of the equipment of these railroads, see Appendix III, Table VIII. In 1896 the ore roads of the old ranges were increased in number by the completion of the Lake Superior and Ishpeming Railway. The dock of this company is at Presque Isle, 3 miles north of Marquette Harbor proper. During 1897 this road hauled about 1,100,000 tons of ore.

[4] There are now on Lakes Michigan and Superior 21 of these docks, having a total of 4,438 pockets, with a combined storage capacity of 617,250 gross tons, erected at a cost of about $6,800,000. They are located as follows: 5 at Two Harbors, 2 at Duluth, 1 at Superior, 3 at Ashland, 4 at Marquette, 5 at Escanaba, and 1 at Gladstone. For particulars about these docks, see Appendix III, Table VII.

directly into cars and carried by railroad to furnaces located from 60 to 475 miles from Lake Erie ports.

Thus far attention has been directed merely to the labor which is economized by the improved docks that have been constructed. But these docks are also partially responsible for the very low transportation charges that prevail. Instead of losing days in loading and unloading, as was once the case, but a few hours are now lost. Vessels lose almost no time at all at the docks; it is almost literally true that they are constantly going or coming. With the finely comminuted ores of the Mesabi range, which do not run so rapidly from the pocket down the chutes as the hard and lumpy ores, vessels can be loaded in seventy minutes with 2,500 tons of ore.[1]

At Two Harbors 3,028 tons of hard ore were loaded in seventy minutes; vessels frequently load and depart with a cargo of 3,500 to 4,000 tons within two hours of the time they reach port. There is also great expedition in the unloading of vessels. With the appliances possessed by the best docks, the largest vessels have been unloaded in twelve to fourteen hours.[2]

At the new dock at Conneaut, which is to be operated in connection with the Bessemer Steamship Company's fleet and the Pittsburg, Bessemer and Lake Erie Railroad, it is confidently expected the largest vessels will be unloaded regularly in ten hours, and it is hoped that in all but special cases the time will be reduced to seven hours. The new plant is equipped with 12 legs, one for each hatch of the vessel. When all the legs are at work, it is hoped the capacity of the plant will be between 900 and 1,000 tons per hour; and if this speed is attained vessels of the 6,000-ton type can be unloaded in less than seven hours. It is perhaps unnecessary to direct attention to the fact that a vessel's daily expenses are almost as large while in port as during passage, and therefore that dispatch in loading and unloading means a large saving. Of course, there is practically no expense for fuel while the vessel is in port, but this is the only item of importance which is materially reduced, and it is not of so great importance as is usually imagined—this item, e. g., being only 28 per cent of the total cost of running the ships of the Peninsular and Oriental Steamship Company.[3] It would be less for lake vessels.

Not only has the volume of the business in iron ores warranted the expenditure of large sums on terminal facilities, but also the expenditure of even larger amounts on the instruments of transportation. Vessels of great size and of special design have been constructed for this trade. The entire storage space of the new ships is usually divided by five bulkheads into four large holds extending from the water bottom to the shelter deck. This permits economical handling and trimming

[1] The dispatch with which vessels are now loaded will, perhaps, be better appreciated if comparison is made with the crude methods which once prevailed. In the early days on the Marquette range the ore was conveyed from the mines in wagons and dumped on a dock. From the dock the ore was transferred to the ship by the ship's crew. After a time a tramroad was built on which the cars were drawn out upon the dock by mules, where the ore was dumped upon an apron, from which it could easily be loaded onto the ship. In this apron we have the rudimentary pocket. It was not long after the construction of this road that the pockets, which are now such an important adjunct of the docks, made their appearance in an experimental way. With the construction of the railroad from the mines of the Marquette range to the shipping port of the same name the system of handling ore which now obtains was perfected.

[2] This represents a vast improvement over the primitive methods which were in vogue until twelve or thirteen years ago. Formerly the ore was lifted from the hold in buckets by horse power, dumped into wheelbarrows, wheeled back on the dock, *and emptied* on the stock pile.

[3] *Report of Commissioner of Navigation*, 1894, p. 25.

of cargo. The strength usually obtained by transverse bulkheads is, in the main, secured by deck beams, extra shell plating, stanchions, and intercostals. Several of the iron ore companies have built fleets adapted to the requirements of the ore business. The Bessemer Steamship Company has a fleet of nine large steamers and nine barges, all of recent design and construction. These vessels have an aggregate gross tonnage of 58,525 tons and a total net registered tonnage of 48,620 tons, and have an actual carrying capacity of 79,400 gross tons on a mean draft of 16 feet and 10 inches. The Minnesota Steamship Company has a fleet capable of carrying 52,450 gross tons per trip on a draft of 17 feet.[1]

It was estimated that the floating equipment on the Great Lakes January 1, 1896, employed primarily in the transportation of ore, had a value of $46,680,207,[2] and it has since been largely increased.

The ores of the Lake Superior region have qualities that render them very valuable to the iron masters of the iron and steel producing districts of the Eastern States, and therefore it becomes desirable to move them. It is the perfection of the transportation facilities that renders this possible. Effective terminal facilities, together with efficient instruments of carriage, have made possible the very low freight rates that have prevailed and without which the ore could not be moved. During the navigation season of 1896 large quantities of ore were carried from the head of Lake Superior to the lower lake ports, a distance of 889 statute miles,[3] for 60 cents per gross ton, which is equivalent to a ton-mile charge of but 0.67 of a mill.[4] This rate, although very low, was much reduced during the summer of 1897, the rate being but 50 cents for some weeks. This rate is equal to but 0.56 of a mill.

When it is remembered that a ton-mile charge of 3 mills on railroads is regarded as something exceptional, it will be realized how very low the lake rates on iron ore are. Mr. Carnegie states that the directors of the new mineral road between Conneaut, on Lake Erie, and Pittsburg hope to reduce the cost of hauling ore and coal below 3 mills per ton.[5] If lake rates were as high as rail rates the ore of Minnesota could not be moved. When it is known that the price of red hematites of Besse-

[1] In the subjoined table the equipment of several of the largest ore fleets may be found:

Name of fleet.	Net registered tonnage.	Actual carrying capacity.	Mean draft.
			Ft. In.
Bessemer Steamship Co.:			
Nine steamers	25,080	41,700	16 10
Nine barges	23,540	37,700	16 10
One steamer (building)	.....	6,625	16 10
Two barges (building)	.....	14,000	16 10
Minnesota Steamship Co.:			
Nine steamers	19,735	30,250	17 0
Five barges	13,629	22,200	17 0
One schooner (building)	.....	6,000	.....
Cleveland Cliffs Iron Co.:			
Seven steamers	7,329	18,750	.....
Two schooners	1,554	3,175	.....
One steamer (building)	.....	5,750	.....
Lake Superior Iron Co.: Six steamers	8,750	16,116	16 10
Menominee Transit Co.: Five steamers	9,376	15,025	16 10
Mutual Transportation Co.: Four steamers	8,344	13,747	16 10

[2] Blue Book of American Shipping (1896), p. 205.

[3] This is the distance given in Eleventh Census, Transportation Business, Part II, p. 291, from Duluth to Ashtabula, the chief receiving port of Lake Erie.

[4] Out of this very low rate the vessels paid 2½ to 3 cents for trimming and 16 cents per ton for discharging cargoes. Freight rates and charges are for gross tons.

[5] Iron Age, Vol. LVIII, No. 14, p. 622.

mer quality in Cleveland during the early spring of 1895 was but $2.80,[1] and that the price of this ore varied from $4 to $4.25[2] in the summer and autumn of 1896, and in 1897 fell below 1895 prices,[3] it will be understood how absolutely important it is that freight rates should be low. If the ton-mile rate were 3 mills—which is regarded as exceptionally low on railroads—the freight charge for transporting ore from Duluth to Cleveland would be $2.54—a rate higher than the traffic could bear.

In view of the facts that have been presented it ought not to be difficult to understand why the ores of the Lake Superior region are supplanting the ores of the eastern region. This substitution has been going on rapidly, and should the demand for steel continue to increase at the expense of that for iron, this substitution[4] will persist unless methods be discovered by which good steel can be made cheaply from ores that can not now be used to advantage.

APPENDIX III.

TABLES RELATING TO LAKE TRANSPORTATION AND THE IRON-ORE INDUSTRY.

TABLE I.

*Shipments of iron ore from the Lake Superior region.**

Year.	Long tons.	Year.	Long tons.	Year.	Long tons.	Year.	Long tons.
Previous to 1854	75,083	1864	243,127	1876	992,764	1887	4,738,903
1854	3,000	1865	236,208	1877	1,014,687	1888	5,023,279
1855	1,449	1866	278,796	1878	1,111,110	1889	7,390,387
1856	36,343	1867	473,567	1879	1,375,691	1890	9,003,701
1857	25,646	1868	491,449	1880	1,908,647	1891	7,094,981
1858	15,876	1869	617,444	1881	2,314,502	1892	9,073,568
1859	68,832	1870	830,940	1882	2,966,375	1893	6,065,795
1860	114,401	1871	779,607	1883	2,341,227	1894	7,755,494
1861	49,909	1872	900,901	1884	2,518,048	1895	10,429,037
1862	124,169	1873	1,162,458	1885	2,456,548	1896	9,934,446
1863	203,055	1874	919,557	1886	3,562,570	1897	12,469,638
		1875	891,257				

* The figures given in this table include the amounts shipped by all-rail routes; the quantities thus transported are, however, relatively unimportant. In 1892 the all-rail shipments were 525,768 gross tons; in 1893, 194,127; in 1894, 133,874; in 1895, 194,127; in 1896, 290,410, and in 1897, 253,993 gross tons. The all-rail shipments for 1892 were obtained from Mineral Resources of the United States (1892), p. 39, and the figures for 1893–96 were taken from the Blue Book of American Shipping (1897), p. 118, and for 1897 from The Iron Trade Review. Lake shipments of iron ore as given by Birkinbine in The Production of Iron Ores in Various Parts of the World (p. 195) are as follows: In 1892, 8,545,313 gross tons; in 1893, 5,836,749; and in 1894, 7,621,620 gross tons.

The first experimental shipment of iron ore from the Lake Superior region was from the Marquette range and occurred in 1850; but shipments from this range for commercial purposes did not begin until 1853. See Mineral Resources of the United States (1891), p. 49. The shipments previous to 1854 are given in Mineral Resources of the United States (1889 and 1890), p. 27; for the years 1854 to 1886, ibid. (1886), p. 15; for 1887 and 1888, ibid. (1888), p. 17; for 1889 to 1893, ibid. (1892), p. 36; for the years 1893 to 1896, Blue Book of American Shipping (1897), p. 118; for the year 1897, Mr. A. I. Findley, editor of The Iron Trade Review.

[1] Iron Age, Vol. LVII, No. 2, p. 155.

[2] Ibid., Vol. LVII, No. 22, p. 1263, and Vol. LVIII, No. 13, p. 595. In 1894 Bessemer standard ores sold for $2.65 per ton and non-Bessemer for $2 per ton at lower lake ports. (Ibid., Vol. LVII, No. 1, p. 24.)

[3] The prices of some of the standard lake ores in 1897 delivered at Lake Erie ports were as follows:

Minnesota hard ore, crushed	$3.11
Chandler	2.92½
Norrie	2.65
Lake Angeline, hard ore	3.46
Burt Mine, Mesabi	2.65
Chapin	2.40
Red hematites, non-Bessemer quality	$2.00 to 2.50

[4] There is no likelihood that the ores of this region will be speedily exhausted. Mr. *John Birkinbine says* of the Mesabi: "No other iron range thus far discovered pos-

TABLE II.

Production of iron ore in the lake districts of the several States of the Lake Superior region, in the lake region as a whole, in the United States, and importations into the United States.

[Long tons.]

Year.	Michigan.	Michigan.	Lake district of Wisconsin.	Minnesota.	Total for the Lake Superior region.	Total for the United States.	Importations.
Unknown	91,850	.....	.....	.....	.....	.....	.....
1854	3,000	.....	.....	.....	.....	.....	.....
1855	1,449	.....	.....	.....	.....	.....	.....
1856	6,790	.....	.....	.....	.....	.....	.....
1857	25,626	25,646	.....	.....	25,646	.....	.....
1858	22,876	22,876	.....	.....	22,876	.....	.....
1859	68,832	68,832	.....	.....	68,832	.....	.....
1860	114,401	114,401	.....	.....	114,401	2,873,459	.....
1861	49,909	114,258	.....	.....	114,258	.....	.....
1862	124,169	124,169	.....	.....	124,169	.....	.....
1863	203,055	203,055	.....	.....	203,055	.....	.....
1864	243,137	247,059	.....	.....	247,059	.....	.....
1865	187,106	193,758	.....	.....	193,758	.....	.....
1866	288,806	296,713	.....	.....	296,713	.....	.....
1867	457,642	465,504	.....	.....	465,504	.....	.....
1868	510,522	510,522	.....	.....	510,522	.....	.....
1869	629,532	639,097	.....	.....	639,097	.....	.....
1870	861,403	859,507	.....	.....	859,507	3,031,891	.....
1871	813,379	813,984	.....	.....	813,984	.....	.....
1872	952,077	948,553	.....	.....	948,553	.....	27,000
1873	.....	1,195,234	.....	.....	1,195,234	.....	62,000
1874	.....	935,488	.....	.....	935,488	.....	69,000
1875	.....	910,840	.....	.....	910,840	4,500,000	83,000
1876	.....	993,311	.....	.....	993,311	.....	26,000
1877	.....	1,025,129	.....	.....	1,025,129	.....	42,000
1878	.....	1,125,093	.....	.....	1,125,093	.....	29,000
1879	.....	1,414,182	.....	.....	1,414,182	.....	284,141
1880	.....	[1,640,814] 1,973,455	[000] 14,143	[000]	1,640,000 1,987,598	[7,120,362]	 493,408
1881	.....	2,123,404	197,911	.....	2,321,315	7,974,000	782,887
1882	.....	2,672,287	276,020	.....	2,948,307	9,744,000	589,655
1883	.....	2,518,048	62,175	.....	2,580,223	.....	490,875
1884	.....	2,225,148	34,612	62,122	2,321,882	8,556,330	487,820
1885	.....	2,203,599	55,181	227,075	2,485,855	7,600,000	390,786
1886	.....	3,175,959	150,294	307,948	3,634,201	.....	1,039,433
1887	.....	3,933,681	400,104	394,910	4,728,695	.....	1,194,301
1888	.....	4,113,803	381,140	511,953	5,006,896	.....	587,470
1889	.....	5,856,169	798,937	864,508	7,519,614	14,518,041	853,573
1890	.....	7,141,656	549,359	891,910	8,944,031	16,036,043	1,246,830
1891	.....	6,127,001	910,465	945,105	7,621,465	14,591,178	912,864
1892	.....	7,543,544	765,379	1,255,465	9,564,388	16,296,666	806,585
1893	.....	4,668,324	426,367	1,499,927	6,594,618	11,587,629	526,951
1894	.....	4,419,074	305,011	2,968,463	7,692,548	11,879,679	167,307
1895	.....	5,812,444	590,081	3,866,453	10,268,978	15,957,614	524,153
1896	.....	5,706,736	575,743	4,283,880	10,566,359	16,005,449	682,806

NOTES TO TABLE II.

Up to the census year 1880 the statistics given in the census reports covering the production of iron ore in the United States, and those of the production in the several States in particular, are very unsatisfactory. For the reports of 1850, 1860, and 1870 the statistics of production were very largely obtained from the statements made by the managers of the various blast furnaces as to the amount of ore consumed. The tables do not specify in what States the ore was produced, but merely give the amounts reported as being consumed by the blast furnaces. This being the case, in giving the production of the States in the early years I have used,

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sesses greater apparent reserves. Conservative estimates formulated from the records of properties now exploited and worked, together with others determined by systematic explorations and analyses, show that the Mesabi range can supply ore (which will equal in average iron and phosphorous contents) double the quantity (or 200,000,000 gross tons) which the entire Lake Superior region has produced in fifty years. In this estimate there are not included a number of properties which have been imperfectly explored." (The Production of Iron Ores in 1895, p. 16.) Since M. Birkinbine wrote many new deposits have been explored and his estimates must now be regarded as falling far short of the amount of ore this range contains.

wherever it has been possible, the statistics given in Mineral Resources of the United States, as they seemed the more reliable. The census figures for 1880 appear to be accurate, and as it was necessary to use them in some cases they are given in all cases where they occur. The only objection to them is the fact that they are not for the calendar year. These figures are here inclosed in brackets. It is to be remembered that the census year 1880 ended May 31, 1880. In other cases, unless otherwise stated, the year here referred to is the calendar year.

The figures of the column headed "Total for the United States" were obtained from the following sources: For the year 1860, Eighth Census, Manufactures, p. clxxvii; for 1870, Ninth Census, Industry and Wealth, p. 768; for 1875, Tenth Census, Mining Industries, p. 33; for 1880, Eleventh Census, Mineral Industries, p. 12; for 1881, 1882, and 1884, Tenth Census, Mining Industries, p. 33; for 1885, Mineral Resources of the United States (1885), p. 188, and for 1889 and the succeeding years down to 1896, The Production of Iron Ores in the United States (1895), p. 10. The statement for 1896 was obtained from The Production of Iron Ores in 1896, by John Berkinbine, p. 23. In some cases short tons have been converted into long tons. The compilers of the Ninth Census think the production of 1870 as given is underestimated by about eight or nine hundred thousand tons (Ninth Census, Industry and Wealth, p. 749). For the years 1875 and 1881 the amounts given are estimates made by Mr. I. Lowthian Bell, and the amounts given for 1882, 1884, and 1885 are estimates made by Mr. James M. Swank, general manager of the American Iron and Steel Association. The figures of importation into the United States from 1872 to 1891 were obtained from Mineral Resources of the United States (1891), p. 41; from 1892 to 1894, from The Production of Iron Ores in Various Parts of the World, p. 198; for 1895, from The Production of Iron Ores in the United States, p. 25, and for 1896 The Production of Iron Ores in 1896, by John Berkinbine, p. 26.

In giving the production of the States forming the lake region it was thought best to include only the ore mined within this region; Wisconsin's product is therefore somewhat less than that usually reported for the State. The figures of production up to 1889 were obtained from Mineral Resources (1889 and 1890), p. 30, and since 1889, by assigning to Wisconsin the difference between the total output of the Lake Superior region and the combined output of Michigan and Minnesota. Michigan's output, as it appears in the first column, is given in the Geological Survey of Michigan (1869–1873), Vol. I, Part I, Atlas Plate 12. It is not contended that these figures are exact. To some small extent the figures of the second column are of my own deduction. Up to the time when Wisconsin became a producer I have given Michigan credit for the total yield of the Lake Superior region. In Mineral Resources (1883), p. 116, it is stated that the total output for the lake region for 1856 and the previous years was 86,319 gross tons; this might also be placed in the second column. It will be noted that this amount does not correspond with the first column. From 1880 to 1889 the difference between the total amount mined in the lake region and the combined output of Minnesota and Wisconsin is assigned to Michigan. Since 1889 it is given as reported in The Production of Iron Ores in the United States (1895), p. 10; for 1896 see The Production of Iron Ores in 1896, by John Birkinbine, p. 23.

No ore was raised in Wisconsin from the mines of the lake region up to the close of the census year 1880; there was, however, some ore mined in this district during the calendar year 1880. For Wisconsin's output from 1880 to 1888 see Mineral Resources (1889 and 1890), p. 31. Since 1888 that portion of the total production of the lake region not belonging to either Michigan or Minnesota has been assigned to Wisconsin. For Minnesota's yield of ore from 1884 to 1888 see Mineral Resources (1889 and 1890), p. 31, and from 1888 to 1895, The Production of Iron Ores in the United States (1895), p. 10; and for 1896, The Production of Iron Ores in 1896, by John Birkinbine, p. 23.

Down to 1882 the figures for the production of the lake region as a whole were taken from Mineral Resources (1883), p. 116; for the years from 1883 to 1888 the figures are those of Mineral Resources (1891), p. 38; for the years 1888 to 1894, Production of Iron Ores in Various Parts of the World (1894), p. 195; for the production of 1895, The Production of Iron Ores in the United States (1895), p. 12; and for the production of 1896, The Production of Iron Ores in 1896, by John Birkinbine, p. 8.

TABLE III.

Production of iron ore in the Cornwall Ore Hills of Pennsylvania and the Lake Champlain district of New York, in New York, New Jersey, Pennsylvania, and Ohio, and the total for these States.

[Long tons.]

Year.	Cornwall Ore Hills.	Lake Champlain district.	New York.	New Jersey	Pennsylvania.	Ohio.	Total for these States.
	11 months.						
1864	165,915	.....	.....	226,000	.....	.....	.....
1865	114,803	.....	.....	.....	.....	.....	.....
1866	216,660	.....	.....	.....	.....	.....	.....
1867	202,755	.....	.....	275,067	.....	.....	.....
1868	165,843	.....	.....	.....	.....	.....	.....
1869	173,429	.....	.....	.....	.....	.....	.....
1870	174,408	.....	*a* (469,190)	(323,782)	(978,112)	(282,615)	2,053,699
1871	176,055	.....	.....	450,000	.....	.....	.....
1872	193,317	350,000	.....	600,000	.....	.....	.....
1873	166,782	420,000	.....	665,000	.....	.....	.....
1874	112,429	250,000	.....	525,000	.....	.....	.....
1875	98,925	300,000	.....	390,000	.....	.....	.....
1876	137,902	290,000	.....	285,000	.....	.....	.....
1877	171,589	365,000	.....	315,000	.....	.....	.....
1878	179,299	380,000	.....	409,674	.....	.....	.....
1879	268,488	480,000	.....	488,028	.....	.....	.....
1880	231,173	700,000	*b*[1,126,899]	[676,225] 745,009	[1,951,496]	[488,753]	4,243,372
1881	249,050	637,000	.....	737,052	.....	.....	.....
1882	309,681	725,000	.....	932,762	.....	.....	.....
1883	363,144	540,000	.....	521,416	.....	.....	.....
1884	412,320	530,000	.....	393,710	.....	.....	.....
1885	508,864	420,000	.....	330,000	.....	.....	.....
1886	688,054	588,829	.....	500,501	.....	344,484	.....
1887	667,210	768,852	.....	547,889	.....	377,465	.....
1888	722,917	669,553	.....	447,738	.....	253,352	.....
1889	769,020	779,900	1,247,537	415,510	1,560,234	254,294	3,477,575
1890	686,302	821,994	1,253,393	495,808	1,361,622	169,088	3,279,911
1891	663,746	554,865	1,017,216	525,612	1,272,928	104,487	2,920,243
1892	634,714	.....	891,099	465,455	1,084,047	95,768	2,536,369
1893	439,705	.....	534,122	356,150	697,985	68,141	1,656,398
1894	371,710	.....	242,759	277,483	532,087	58,493	1,110,822
1895	614,598	.....	307,256	282,433	900,340	44,834	1,534,863
1896	463,059	.....	385,477	264,999	747,784	58,480	1,456,740

a The figures inclosed in parentheses are those of the Ninth Census: Industry and Wealth, p. 768, and, as has already been explained in the notes to Table II, they are of doubtful value.

b The figures inclosed in brackets are for the census year 1880, see Eleventh Census: Mineral Industries, p. 13.

NOTES TO TABLE III.

The sources from which the output of the Cornwall Ore Hills was obtained are as follows: From 1864 to 1890 Mineral Resources (1889 and 1890), p. 29; for 1891, Ibid., p. 41; for 1892, Ibid., p. 40; for 1893, Ibid., p. 43; for 1894, Production of Iron Ores in Various Parts of the World, p. 184; and for 1895, Production of Iron Ores in the United States, p. 20; and for 1896, The Production of Iron Ore in 1896, by John Birkinbine, p. 21. For the production of iron ore in the Lake Champlain district see Mineral Resources (1891), p. 41. For New Jersey's output down to 1889, see Geological Survey of New Jersey (1893), p. 443. In Mineral Resources (1891), p. 41, may be found Ohio's output for the years from 1886 to 1888. The production of each of the States from 1888 to 1896 is as given in Production of Iron Ores in the United States, p. 10; for production during 1896, see The Production of Iron Ores in 1896, by John Birkinbine, p. 23.

TABLE IV.

Production of iron ore in Alabama, Tennessee, Georgia, and the total for these States.

[Long tons.]

Year.	Alabama.	Tennessee.	Georgia.	Total.
1870	.....	30,909	.....	30,909
1880	[171,139]	[93,272]	[81,621]	[346,032]
1881	220,000	.....	.....	.....
1882	250,000	.....	.....	.....
1883	385,000	.....	.....	.....
1884	420,000	.....	.....	.....
1885	505,000	.....	.....	.....
1886	650,000	.....	.....	.....
1887	675,000	.....	.....	.....
1888	1,000,000	.....	.....	.....
1889	1,570,319	473,294	248,020	2,291,633
1890	1,897,815	465,695	244,088	2,607,598
1891	1,986,830	543,923	250,755	2,781,508
1892	2,312,071	406,578	185,054	2,903,703
1893	1,742,410	372,996	a 186,015	a 2,301,421
1894	1,493,086	292,831	a 174,694	a 1,960,611
1895	2,199,390	519,796	a 272,014	a 2,991,200
1896	2,041,793	535,484	a 175,331	a 2,752,608

a Including North Carolina, which has two and generally but one small establishment mining ore

NOTES TO TABLE IV.

All of the figures for 1870 were obtained from Ninth Census: Industry and Wealth, p. 768; they are open to the same criticism as the figures for 1870 of Table II. Those of Alabama and Tennessee for 1880 were obtained from Eleventh Census: Mineral Industries, p. 13; they are therefore for the census, not for the calendar, year. For 1880 the production of Georgia is given in Tenth Census: Mining Industries, p. 23. Alabama's production for the years 1881 to 1888 is given in Mineral Resources (1891), p. 19; these figures are estimates based on the production of pig iron. Since 1889 the production of each of the States is that given in The Production of Iron Ores in the United States (1895), p. 10. For 1896 the statistics were obtained from The Production of Iron Ore in 1896, by John Birkinbine.

TABLE V.

Shipments of Lake Superior iron ore by ports (gross tons).

[Data furnished by A. I. Findley, editor of The Iron Trade Review.]

Year.	Marquette.	Escanaba.	St. Ignace.	L'Anse.	Ashland.
1884	918,489	1,356,587	51,109	64,420	.....
1885	750,047	1,219,777	93,588	20,027	119,563
1886	853,396	1,538,821	74,590	.....	721,983
1887	803,411	2,072,708	91,554	.....	1,040,727
1888	844,694	2,202,965	107,390	.....	1,016,414
1889	1,376,335	3,003,632	51,853	.....	1,484,802
1890	1,307,395	3,714,662	.....	.....	2,123,856
1891	1,056,027	3,058,590	.....	.....	1,261,658
1892	1,026,338	4,010,085	.....	.....	2,223,684
1893	1,086,934	2,048,981	.....	.....	1,117,520
1894	1,424,850	1,644,776	.....	.....	1,738,590
1895	1,079,485	2,860,172	.....	.....	2,350,219
1896	1,578,600	2,321,928	.....	.....	1,566,336
1897	1,945,519	2,302,121	.....	.....	2,067,637

Shipments of Lake Superior iron ore by ports (gross tons)—Continued.

Year.	Two Harbors.	Gladstone.	Superior.	Duluth.	Total.
1884	.....	.....	.....	.....	2,390,605
1885	225,484	.....	.....	.....	2,428,486
1886	304,396	.....	.....	.....	3,493,186
1887	390,467	.....	.....	.....	4,398,857
1888	450,475	.....	.....	.....	4,621,947
1889	819,639	68,250	.....	.....	6,804,511
1890	826,063	91,091	.....	.....	8,063,067
1891	890,299	177,866	.....	.....	6,444,440
1892	1,165,076	115,886	4,245	.....	8,545,314
1893	903,329	203,585	80,273	440,592	5,881,214
1894	1,373,253	79,208	.....	1,369,252	7,629,829
1895	2,118,156	109,211	117,884	1,598,783	10,233,910
1896	1,813,992	220,888	167,245	1,988,932	9,657,921
1897	2,651,465	341,014	531,825	2,376,064	12,215,645

Receipts of Lake Superior iron ores, by vessel, at lake ports (gross tons).

[Data furnished by A. I. Findley, editor of the Iron Trade Review.]

Year.	Toledo.	Sandusky.	Huron.	Lorain.	Cleveland.	Fairport.
1880	.....	.....	.....	.....	758,983	.....
1881	.....	.....	.....	.....	826,419	.....
1882	.....	.....	.....	.....	993,046	.....
1883	27,617	58,825	.....	25,794	723,129	40,334
1884	2,444	166,540	.....	30,156	904,850	23,100
1885	15,000	143,180	.....	13,180	589,234	31,992
1886	26,960	157,970	44,021	99,744	1,034,650	112,000
1887	61,729	160,600	21,288	134,764	1,216,423	501,368
1888	75,601	154,924	4,351	197,000	971,775	611,140
1889	82,961	186,082	680	280,000	1,742,415	829,121
1890	164,295	174,596	1,200	280,450	1,945,492	1,096,408
1891	191,105	106,907	14,910	266,009	1,257,775	699,434
1892	139,987	49,736	65,000	190,400	1,950,224	866,611
1893	145,515	4,464	137,700	165,667	1,260,716	792,517
1894	158,384	23,043	172,775	150,424	1,624,573	976,222
1895	260,730	12,361	146,442	244,219	2,312,370	914,617
1896	301,794	58,667	226,515	191,445	2,313,170	941,446
1897	416,438	79,792	198,231	355,188	2,456,704	1,008,340

Year.	Ashtabula.	Conneaut.	Erie.	Buffalo, Tonawanda. *a*	Total.	Receipts of other lake ports. *b*
1880	298,594	.....	.....	.....	.....	.....
1881	377,976	.....	.....	.....	.....	.....
1882	598,037	.....	.....	.....	.....	.....
1883	670,000	.....	106,787	40,203	1,692,689	.....
1884	650,000	.....	116,027	8,760	1,841,877	548,728
1885	582,000	.....	122,223	7,160	1,503,969	924,517
1886	672,000	.....	91,250	31,869	2,270,554	1,222,632
1887	1,103,839	.....	20,488	28,699	3,439,198	959,659
1888	1,288,530	.....	240,338	240,000	3,783,659	838,288
1889	1,963,490	.....	373,595	298,000	5,856,344	948,167
1890	2,176,730	.....	487,493	548,000	6,874,664	1,188,403
1891	1,599,785	.....	393,759	410,000	4,939,684	1,504,756
1892	2,555,416	1,130	645,230	197,000	6,660,734	1,884,580
1893	1,845,738	203,207	469,299	308,238	5,333,061	548,153
1894	1,987,722	237,905	624,438	395,339	6,350,825	1,279,004
1895	2,474,791	244,967	811,989	719,742	8,112,228	2,121,682
1896	2,272,822	327,623	847,849	545,101	8,026,432	1,631,489
1897	3,001,914	495,327	1,311,526	797,446	10,120,906	2,094,739

a Buffalo alone to 1893.

b Most of this ore was received at South Chicago.

TABLE VI.

Freight rates, by lake vessel, on iron ore per long ton from ports named to Lake Erie ports.

Year.	Escanaba.			Marquette.			Ashland, Superior, Duluth, and Two Harbors.		
	Rate.	Wild or daily rate.	Contract rate.	Rate.	Wild or daily rate.	Contract rate.	Rate. *a*	Wild or daily rate.	Contract rate.
1856				$3.00					
1857				3.00					
1858				$2.00 to 2.50					
1859				2.00 to 2.50					
1860				2.00 to 2.50					
1861				2.00 to 3.00					
1862				2.25 to 4.50					
1863				3.00 to 4.00					
1864				3.00 to 5.00					
1865				2.05 to 5.00					
1866	$2.50 to $5.75			2.75 to 6.50					
1867	1.05 to 3.05			2.00 to 4.00					
1868	1.06 to 2.06			2.25 to 3.25					
1869	1.05 to 2.05			2.75 to 4.50					
1870	1.65 to 2.50			2.05 to 3.25					
1871	1.50 to 2.50			2.05 to 4.00					
1872	2.00 to 5.25			2.85 to 6.60					
1873	2.30 to 3.00			3.25 to 4.00					
1874	1.30 to 1.40			1.60 to 2.50					
1875	1.10 to 1.30			1.30 to 1.50					
1876	.70 to 1.40	$0.86	$1.20	1.25 to 2.20	$1.35	$1.50			
1877	.65 to 1.50	.98	1.00	1.25 to 2.00	1.41	1.40			
1878	.60 to 1.15	.81	.90	1.00 to 1.50	1.22	1.30			
1879	.70 to 2.10	1.25	.90	1.25 to 3.00	1.83	1.40			
1880	1.50 to 2.00	1.70	1.85	2.00 to 2.75	2.26	2.75			
1881	1.00 to 1.60	1.36	1.75	2.00 to 2.30	2.05	2.45			
1882	.90 to 1.40	1.04	1.40	1.25 to 2.00	1.26	1.75			
1883	.90 to 1.50	1.22	1.00	1.30 to 1.75	1.40	1.20			
1884	.65	.87	1.10	1.00	1.08	1.35			
1885	1.00	.78	.90	1.40	.98	1.05	$1.07 to $1.65	$1.25	$1.15
1886	1.35	1.28	1.05	1.75	1.51	1.20	1.02 to 3.00	1.78	1.20
1887	1.75	1.59	1.40	2.15	1.87	1.63	1.75 to 2.75	2.23	2.00
1888	.90 to 1.45	1.05	.90	1.10 to 1.15	1.30	1.15	1.02 to 1.08	1.43	1.25
1889	.90 to 1.25	1.01	1.00	.90 to 1.25	1.19	1.10	1.25 to .90	1.34	1.25
1890	1.10 to 1.00	.89	1.10	1.25 to 1.10	1.07	1.25	1.35 to 1.00	1.17	1.35
1891		.84	.65		1.02	.90		1.11	1.00
1892		.74	1.00		.98	1.15		1.15	1.25
1893		.56	.85		.71	1.00		.77	1.00
1894		.46	.60		.60	.80		.78	.80
1895		.73	.55		.92	.75		1.13	.80
1896		.52	.70		.66	.95		.77	1.05
1897		.45	.45		.55	.65		.57	.70

a Rates from Ashland alone.

NOTES TO TABLE VI.

Out of the rate that is received the vessels pay trimming and unloading charges. In 1895 and 1896 these amounted to 19 cents per ton and in 1897 to 16.5 cents. Some few boats do not trim, and thus escape the trimming charge, which in 1895 and 1896 varied from 2.5 to 3 cents, and in 1897 was 2.5 cents. All vessels pay the unloading charges, which in 1897 were 9 cents for shoveling the ore into buckets lowered into the ship's hold and 5 cents as a dock charge.

The rates as given in the first column for each port were obtained from Mineral Resources of the United States, 1889–90, pp. 27–31. They were compiled by the State commissioner of mineral statistics of Michigan. The other rates were compiled by the Marine Review, of Cleveland.

TABLE VII.

*Record of ore-shipping docks on the Great Lakes.**

Railway.	Location.	Dock No.	Length of dock.	Width of dock.	Height of dock (water to deck).	No. of pockets.	Storage capacity.
			Feet.	*Ft. In.*	*Ft. In.*		*Gross tons.*
Duluth and Iron Range R. R.	Two Harbors, Minn ..	1	1,056	41 0	45 6	141	18,000
		2	1,056	41 0	46 6	176	23,900
		3	540	49 0	51 6	90	16,000
		4	1,008	49 0	51 6	168	30,000
		5	1,008	49 0	54 0	168	33,000
Duluth, Missabi and Northern Rwy.	Duluth, Minn.....	1	2,304	52 0	53 8½	384	57,600
		2	1,152	52 0	57 8½	192	34,560
Duluth, Superior and Western R. R.	Allouez Bay, Superior, Wis.	1	*a* 600	49 8	52 0	100	15,000
			b 900	49 8	57 0	150	25,500
Chicago and Northwestern Rwy.	Ashland, Wis.....	1	1,404	46 8	54 0	234	36,036
		2	1,404	46 0	45 0	234	24,156
	Escanaba, Mich	1	1,104	37 0	48 6	184	24,104
		2	1,152	37 0	40 3	192	20,928
		3	1,356	37 0	52 8	226	30,284
		c 4	1,500	37 0	48 6	250	32,750
		5	1,392	37 0	53 3	232	43,152
Duluth, South Shore and Atlantic Rwy.	Marquette, Mich.....	1	1,700	40 0	45 0	270	27,000
		3	1,200	53 6	37 0	213	12,780
		4	1,200	36 8	47 3	200	28,000
Lake Superior and Ishpeming Rwy.	.....do	1	1,200	52 0	54 0	200	36,000
Minneapolis, St. Paul and Sault Ste. Marie Rwy.	Gladstone, Mich	1	768	37 0	47 0	120	15,000
Wisconsin Central.	Ashland, Wis.....	1	1,908	36 0	54 6	314	33,500

* From "The Iron Mines of Minnesota." Prepared for the seventy-third meeting of the American Institute of Mining Engineers.
a Old part.
b New extension.
c Destroyed by fire November 30, 1897 but now rebuilding.

TABLE VIII.

*Data relating to ore-carrying railroads of northern Minnesota.**

Railway.	Weight of rails per yard.	Weight of freight locomotives in working order, with tenders.	Number of freight locomotives.	Capacity of standard ore-car.	Number of ore-cars.
	Pounds.			*Gross tons.*	
Duluth and Iron Range R. R.	80	12-wheel locomotives, 123 tons; consolidation locomotives, 88 tons.	12-wheel locomotives, 20; consolidated locomotives, 24.	24	2,293
Duluth, Missabi and Northern Rwy.	60 & 80	10-wheel locomotives, 97 tons; consolidated locomotives, 118 tons.	10-wheel locomotives, 16; consolidation locomotives, 2.	25	1,801
Duluth, Superior and Western R. R.	60	79 tons.....	7	29	600

* The Iron Mines of Minnesota. Prepared for the seventy-third meeting of the American Institute of Mining Engineers. This was the state of these railroads on July 14, 1897.

PART IV.

COAL TRAFFIC.

To the vast extent of territory about the Great Lakes, but especially to the country west and north of the Lakes Michigan and Superior, lake transportation means cheap coal. During the greater portion of the season of 1896 coal was carried from Buffalo to Duluth and Superior, a distance of 997 miles,[1] for 20 cents per ton. It would be a work of supererogation to emphasize what this very low rate means to the people of the Northwest, where fires must be maintained for at least six of the twelve months of the year. To the lake carriers coal means west-bound cargoes. If it were not for coal, nearly all the vessels carrying ore, grain, flour, and lumber to the lower lake ports would be obliged to return "light." During 1896 coal constituted about three-fourths of the west-bound traffic through the Detroit River and 86 per cent of the west-bound traffic through the St. Marys Falls Canal.

During 1896 shipments from the ports of Lakes Erie and Ontario amounted to about 9,000,000 tons.[2] The growth of this enormous traffic from small beginnings in the seventies can not be set forth in detail because of the meagerness of reliable data. Something may, however, be inferred from the growth of the traffic of the leading shipping ports.[3] Shipments of coal from Buffalo have been as follows:

Year.	Tons.	Year.	Tons.
1873	570,443	1890	2,188,682
1875	439,720	1895	2,617,268
1880	589,670	1896	2,400,068
1885	1,448,086		

Most of the anthracite coal consigned by lake is shipped from Buffalo. Erie, Charlotte, Oswego, and Ogdensburg are the other ports shipping large quantities of this coal. But very little bituminous coal is shipped from Buffalo; in 1896 shipments amounted to but 21,000 tons. Bituminous coal is shipped from the Lake Erie ports west of Buffalo—Erie, Conneaut, Ashtabula, Fairport, Cleveland, Lorain, Huron, Sandusky, and Toledo. Cleveland has been the chief shipping port of this form of coal. The growth of the traffic at this port may be seen from the subjoined table:

Year.	Tons.	Year.	Tons.
1887	*a* 723,802	1893	1,522,557
1890	1,287,177	1896	1,803,709

a Includes a small rail tonnage.

In the decade covered by the table there was an increase of 149 per cent in the business of Cleveland. Shipments from the Cuyahoga

[1] This is the distance given in the Eleventh Census, Transportation Business, Part II, p. 288. For several weeks during 1895 coal was carried from Buffalo to Duluth for 15 cents per ton.

[2] Shipments from Ogdensburg are included in this estimate. Nothing in the way of a definite statement can be given, as accurate data are not obtainable. Of all the statistics thus far considered the statistics of the coal business are by far the worst. This is due to the fact that coal, much more than other commodities, is taken on at "intermediate" ports. Much of the business therefore is not recorded on the books of the custom-houses.

[3] These facts may be found in Appendix III, Tables I-V.

customs district, which includes Cleveland, Ashtabula, Lorain, Fairport, and Conneaut, or all the ports shipping large quantities of bituminous coal except Toledo, have grown even more rapidly than the shipments from Cleveland. In 1887, shipments from this district were 1,433,035 tons; and in 1896, 3,863,645 tons, a gain in the ten-year period of 2,430,610 tons or 169 per cent.[1]

In the coal business the ports of destination are much more numerous than the ports of origin. The small ports about the lakes receive not only their own supplies of coal, but to some extent those of the surronnding country as well. The aggregate receipts of the small ports are not very large, however, and so the growth of the receipts of the large ports shows pretty accurately the increase of the business and the shifting of the great distributing centers. Fortunately we have statistics of the receipts at the great distributing ports for a long period of years.[2] Chicago and Milwaukee, at the head of Lake Michigan, and Duluth and Superior, at the head of Lake Superior, are the centers from which the West and Northwest receive their coal. The tables in Appendix IV, Tables VI–VIII, show the growth of the coal business of these cities, and the following table exhibits the present importance of the traffic:

Port.	Total receipts, 1896. *a*
	Tons.
Chicago	6,812,319
Milwaukee	1,587,795
Duluth and Superior	1,775,712

a Only about one-fifth of the receipts of Chicago come by lake. Chicago receives about two-thirds of her supplies from Illinois and Indiana. Duluth and Superior receive their stocks by lake, and Milwaukee obtains nearly all her coal by lake, having received but 100,312 tons by rail in 1896.

The absolute and relative importance of these ports as distributing points is much more accurately indicated by their shipments than by their receipts. The shipments were as follows:

Year.	Chicago shipments. *a*	Milwaukee shipments. *b*	Duluth and Superior receipts. *c*
	Tons.	*Tons.*	*Tons.*
1880	.....	65,390	60,000
1881	.....	121,885	163,000
1882	.....	164,444	260,000
1883	.....	235,771	420,000
1884	.....	205,061	372,000
1885	.....	269,277	592,000
1886	991,053	284,803	736,000
1887	156,037	295,439	912,000
1888	1,471,338	453,837	1,535,000
1889	1,206,608	413,408	1,205,000
1890	1,377,594	522,618	1,780,000
1891	1,344,055	600,888	1,776,000
1892	1,475,624	469,144	1,812,561
1893	1,401,659	532,993	2,126,781
1894	968,132	432,768	2,010,731
1895	999,308	640,470	1,654,882
1896	913,577	446,683	1,775,712
1897	819,686	.....	.....

a See Appendix IV, Table XII, for particulars.
b See Appendix IV, Table XIII, for particulars.
c The shipments of coal from Duluth and Superior can not be obtained. The consumption of coal in Duluth and Superior is small, for the combined population of these two cities is not large, and thus the receipts will answer for comparative purposes almost as well as the shipments. As our interest lies in the rate of increase rather than in its absolute amount, and because it may be assumed that shipments from the ports at the head of Lake Superior have grown fully as fast as the local consumption, the receipts instead of the shipments may be used without changing the results.

[1] Detailed information may be found in Appendix IV, Table III.

[2] The statistics of the receipts are more accurate than those of shipments. The tables compiled by the Chicago bureau of coal statistics, for example, are regarded by those in a position to speak authoritatively as perfectly trustworthy.

By the foregoing table it appears that Chicago has no more than held its own as a distributing point during the period covered by the table, and that shipments from Milwaukee grew from 65,390 tons in 1880 to 600,888 tons in 1891 and fell to 432,768 tons in 1894, but rose to 640,470 tons in 1895, but decreased again in 1896 to 446,683 tons, almost reaching the low figure of 1894. The Duluth-Superior business grew almost without setbacks from 60,000 tons in 1880 to the large volume of 2,126,781 tons in 1893. In 1894 the traffic of these ports fell a trifle short of that of 1893 and in 1895 there was a more decided loss, but in 1896 there was a partial recovery. The movement of coal through the St. Marys Falls Canal in recent years has grown at a much more rapid rate than the receipts of Duluth and Superior. The distribution of coal from Lake Superior points has therefore increased even more rapidly than is indicated by the statistics of the business of Duluth and Superior.[1] Every effort has been made by the coal dealers of Chicago and Milwaukee on the one hand and of Duluth and Superior on the other to secure the trade of the West and Northwest.

Lake rates from the lower lake ports are almost always less to the ports at the head of Lake Superior than they are to the ports at the head of Lake Michigan. Rail rates to the West, on the other hand, seem to favor Milwaukee and Chicago. The territory controlled by these groups of ports expands and contracts with variations in rates, but in a general way the territory supplied by either of them can be located. If a line be drawn from Eau Claire, Wisconsin, to La Crosse and through southeastern Minnesota across northwestern Iowa and to the Missouri River and down this river to Kansas City and then west, all the territory lying to the north and west of this line would be supplied with hard coal from the head of Lake Superior. It would be difficult to indicate the line separating the territory supplied with soft coal by Duluth and Superior from that supplied by Chicago and Milwaukee; it may, however, be said that the line would be somewhat pushed back to the north and west.[2]

In the westward movement of coal from the mines there is the keenest competition between the railroads and the lake carriers. In each case the business is particularly desirable, because it is in the direction in which the least traffic moves. It has already been stated that the eastbound business of both the railroads and the lakes far exceeds the westbound; it therefore becomes particularly desirable to secure westbound freight, for if it be not obtained it means that empty cars must be hauled or vessels run "light."

As Chicago, of all ports in the West, is the point to which the railroads can most successfully meet the competition of the lake carriers, the business of this city will first be discussed. In the contest for Chicago business the lake carriers are at a decided disadvantage in the point of distance. From Buffalo to Chicago by lake is 889 miles, while it is but 523 miles by rail.[3] Thus every mile covered by lake results in the effective westward movement toward Chicago of but 0.588 of a mile. At points south of Lake Erie the railroads would be still more advantageously situated. Nothing more will be said at present, as this matter will be discussed later on.

[1] There is also a shifting of the coal business in the case of the ports about Lake Michigan. A large receiving yard has recently been established on the car-ferry slip of the Chicago and North-Western at Manitowoc.

[2] The coal mines of northern Iowa have suffered a great deal by the severe competition of eastern coal in the northern markets that they once supplied.

[3] This is the distance over the "Nickel Plate"—the New York, Chicago and St. Louis Railroad.

The issue of the struggle for the coal traffic between the lake carriers and the railroads is determined very largely by the kind of coal to be carried. Almost all of the soft coal destined for Chicago is carried by the railroads and the bulk of the hard coal by vessels.[1] The facts explanatory of this strange condition of things are not far to seek. The solution of the difficulty is found in the location of the coal fields and in the character of the coal. Hard coal is mined in a very limited district in eastern Pennsylvania and is therefore favorably situated in respect to the lake route. It can be carried to Buffalo and Erie and yet not be made to deviate very much, so far as the short rail haul to the lake is concerned, from the direct line to Chicago. But this is not all: After the coal has reached Buffalo it is so situated that the greatest possible effective westward movement is linked with its westward journey. In other words, the ineffectual expenditure of energy that takes place in rounding the lower peninsular of Michigan is reduced to a minimum by the almost direct westward movement the whole length of Lake Erie.

The bituminous coal mines in the East that in part supply Chicago with coal are situated well south of Lake Erie. Hocking Valley, the Pittsburg district, and West Virginia are the chief sources in the East from which Chicago obtains soft coal. From these localities the rail-and-lake route can not compete with the all-rail lines because of the long rail haul to the lakes and the circuitous journey around the lower peninsula of Michigan. From Pittsburg to Ashtabula is 127 miles, to Erie 148 miles, and to Cleveland 150 miles, while the total distance from Pittsburg to Chicago over the Pennsylvania Railroad is but 468 miles. From Athens, in the Hocking Valley district, to Toledo over the Columbus, Hocking Valley and Toledo Railroad is 200 miles, while the distance to Chicago is but 390 miles. After the coal has arrived at Toledo it is still 691 miles from Chicago, if it go by lake. At all points south of Athens and Pittsburg the rail-and-lake lines would be at even greater disadvantage, for the combined rail-and-lake distance to Chicago would increase more rapidly than the all-rail distance.

If coal goes by the lake-and-rail routes it must of course be transshipped at the lake ports. In transshipment soft coal breaks very much more than hard. In the case of hard coal the breakage varies from 6 to 8 per cent. No figures can be given for soft coal, as the variations are too great; the breakage does, however, considerably exceed 8 per cent. It needs scarcely to be said that the value of the coal is very much affected by the breakage. As hard coal is damaged less than soft it might be advantageous to ship the former by lake when it would not the latter. It also costs more to unload soft coal than hard at Chicago, the shoveling rate for the former having been 14 cents for several years while the rate for the latter has been but 12 cents. It will be seen later that improved devices are now largely substituted for manual labor in unloading hard coal. It has now, perhaps, been made clear why the bulk of the anthracite coal received at Chicago comes by lake and almost the whole of the bituminous coal comes by rail.

Passing 85 miles north from Chicago to Milwaukee the position of the rail and lake lines is wholly changed. All eastern coal, both hard and soft, received at Milwaukee comes by the lake lines. In 1896 Milwaukee received 100,312 tons of coal by rail, but it was Illinois coal. From the fact that Chicago receives a large portion of her supply of coal from the East by rail and Milwaukee receives no eastern coal by

[1] For the figures see Appendix IV, Table VI.

rail, it may be inferred that the rail haul from Chicago to Milwaukee tips the balance in favor of the lake lines. There is, however, another factor that must be taken account of—the distance by lake to Milwaukee from Lake Erie ports is about 85 miles less than to Chicago, and the rate is usually a few cents less per ton.[1]

In conclusion, a word may be said about the receipts at the head of Lake Superior. It would be inferred that if the railroads can not compete with the lake carriers at Milwaukee they would be less successful at ports further north, and such is the case. Duluth and Superior receive their coal by lake. To the ports at the head of Lake Superior the railroads do not have the advantage in point of distance they possess to ports at the head of Lake Michigan.

No treatment of the transportation of coal by lake would be complete without a discussion of the development of dock facilities for loading and unloading vessels. Until very recent years the crudest methods obtained; but lately wonderful progress has been made, and no one need be surprised if in the near future hard coal be handled as, or even more, expeditiously than iron ore. But few improvements have lately been made in loading anthracite coal; trestles equipped with pockets have long been in use, and vessels have been loaded with dispatch. The *Zenith City* was recently loaded with 5,127 net tons of anthracite coal at the Delaware and Lackawanna trestle in Buffalo in four hours.[2] In the loading of soft coal, however, very great innovations have been made. Until very recently soft coal was shoveled, at a great cost, from cars to buckets and then swung onto the ship by derricks. Soft coal is difficult to handle. Lacking uniformity of shape and size and often occurring in large masses, men find it very difficult to shovel. These peculiarities of shape also make it difficult to construct machinery that will handle it. Its physical texture also presents difficulties; it can not be dropped any great distance without great damage through breakage.

Because of the obstacles that had to be overcome the primitive methods of handling soft coal persisted, but when the traffic assumed large proportions the expense of transshipment and the delays to vessels made it so desirable to institute better methods that every effort was bent to find them, and large sums of money were expended in experimentation. A satisfactory machine would have to attain a high speed at a low cost with but a limited amount of breakage. These requirements seem to be satisfied by the car-dumping machines, of which there are several varieties. An example of the work done by one of these machines will show how well these requirements have been met. A vessel was recently loaded at Cleveland with 5,176 tons of coal in ten hours and thirty minutes at a cost of $13, or a per ton cost of one-fourth of a cent.[3]

A definite statement can not be given of the breakage. It is contended by some that there are machines that handle the coal with less breakage than this particular one, but as yet it is impossible to obtain satisfactory data on this point.

In unloading coal as great advances have been made as in loading. The mechanical obstacles to be overcome in automatically unloading hard coal were not very great, and it is surprising that progress was so slow in view of the immense amount of coal handled, the delay to vessels, and the great cost of labor. Because of its weight and charac-

[1] The cost of unloading soft coal from boats is also a trifle less at Milwaukee than at Chicago.

[2] The Black Diamond, November 27, 1897.

[3] Thirteen dollars very nearly represented the total cost of transshipment, for the expenditures for labor, fuel, and oil and waste were included.

ter coal can only be handled rapidly by men who are strong and endowed with great powers of endurance, and the services of such men have always been costly. Mechanical appliances were from time to time introduced; but, although they cut down the time vessels were delayed by increasing the amount of coal handled in a stated time, they neither reduced the cost of shoveling coal in the ship's hold nor lessened the physical tax on the laborer.[1]

The strain of working in the dusty, stifling holds of vessels was unbearable for any length of time by even the strongest men, and the irregularity with which the men worked, and the irregularity of the employment offered, proved a constant source of trouble between the employees and employers. Finally this tedious method of unloading, coupled, as it always was, with uncertainty[2] and great cost, became intolerable and the self-filling "clam shell" or grab bucket was developed. With the best type of "clam shells" hard coal can be removed with wonderful rapidity and at a very low cost. A contract covering the installation of a plant at Chicago guaranteed that the "clam shell" would develop a speed of three trips per minute. The average load of this bucket is a gross ton. It was also guaranteed that the total cost of removing cargoes and delivering in the yard would not exceed 5 cents per ton for entire cargoes. Some coal has been raised and delivered in the yard for three-fourths of a cent per ton. This coal was directly under the hatches and therefore very accessible. At one of the yards in Milwaukee two vessels, whose cargoes aggregated 7,776

[1] An outline of these improvements will be given. Up to about 1873 coal was handled at Chicago, and presumably at other lake ports, in a very crude way. The coal was removed from the hold of the ship by means of buckets made from kerosene oil barrels (the upper third of which had been sawed off) and a rope lashing for a handle. These buckets were raised by horse power—the horse traveling back and forth. On a temporary stage the coal was dumped into wheelbarrows and then wheeled back over a "spring run" made of planks supported at either end. This work seems to have been difficult, for the men engaged in it received 75 cents per hour. The shovelers in the hold received from 14 to 18 cents per ton. The first important departure from this system was made about 1873. At this time the "mast and gaff" were employed as a derrick. An iron bucket holding about 500 pounds of coal replaced the wooden bucket and steam power was used in hoisting. Instead of being dumped into wheelbarrows the buckets were now emptied into tram cars, which were moved by hand. These improvements greatly reduced the cost of raising the coal from the hold and carrying it back on the dock, but did not reduce the labor of the men in the hold or the cost of shoveling. The second great departure was made when the coal was hoisted up over an inclined track that extended out over the vessel but which could be swung back flush with the dock when the cargo was discharged. Steam was used in hoisting and the buckets were dumped into a hopper in the derrick. Connected with the derrick was an automatic tramway which was higher at the dock than at the point of discharge. The car dumped automatically and was returned automatically by a weight that had been raised by the car as it ran out but which was dropped when the car discharged its load. The buckets now held from 1,200 to 2,200 pounds of coal instead of 500 pounds and also dumped automatically. These improvements still further reduced the cost of handling coal after it was hoisted. They were introduced in the years from 1873 to 1893. In the fall of 1892 Mr. W. S. Bogle built an experimental derrick for the purpose of unloading boats with self-filling "clam-shells," and demonstrated that his plans were practical, provided the proper kind of a rig were built. During the winter of 1892–93 work was continued on the necessary appliances, and in the spring of 1893 the self-filling "clam-shell" proved successful. The "clam-shells" could not be swung either way under the hatch opening, so scrapers were devised (1893) for bringing the coal directly under the hatch. The tramways have also been greatly improved, and coal can now be carried back a mile for the same cost as it can be delivered on the dock front.

All of the old forms of "clam-shells" are operated by steam power. One of the companies constructing this form of machinery is experimenting with an electrical bucket.

[2] The factor of certainty is of great importance. If a master can not know when his ship will be unloaded he is running a great risk in making contracts for new cargoes, and often suffers.

tons, began discharging their cargoes at 8 a. m., and were ready to leave at 8 p. m.[1] For handling soft coal a special form of "grab" has been devised. It works very effectively in view of the obstacles it has to contend against. Its average load is about one-half that of the "clam shells" commonly used in unloading hard coal, or about 1,000 pounds. This grab can also be used in unloading soft coal from open cars. It is a very valuable machine in this occupation, because it does the work that the shovelers find the slowest and hardest. It removes the bulk of the load and thus enables the men to quickly reach the bottom of the car at some point from which they work more effectively.

Before concluding this subject a word must be said about lake freights on coal. A table of these rates may be found in Appendix IV, Tables IX and X. These tables show two things: (1) that the rates are very low as compared with those on other commodities, and (2) that they have fallen very rapidly. For example, the average of daily rates on iron ore from Duluth to Lake Erie ports during 1896 was $1.05 per long ton, while the average of the daily rates on hard coal from Buffalo to Duluth was 24 cents per net ton. The real difference, however, was not so great as the apparent difference. Coal is handled without charge to the vessel, while in the case of iron ore the vessels bear charges for trimming and unloading amounting to 19 cents per ton,[2] and in the former instance the net ton is the unit, while in the latter the long ton is the unit. The coal freights are so low that many vessels never engage in this traffic. They are the vessels of the largest type, but it must not be inferred from this fact that vessels of the largest class are not in general as economical carriers as the smaller ones. It is the loss of time in receiving and discharging cargo that causes the very large vessels to avoid this traffic. Coal docks have not yet been built with sufficient equipment to give the largest vessels dispatch in unloading, and besides, very often, much time is lost in waiting for boats to unload that have precedence. The ore business is the favorite traffic of the large vessels; the dock equipment corresponds to their size, and the business is managed systematically, so serious delays are infrequent. It has already been explained why rates are low. It is simply because the east-bound traffic several times exceeds the west-bound. To the districts where the east-bound business surpasses the west-bound in the largest measure the west-bound rates are the lowest. Hence it is found that the coal rates to Lake Michigan ports are almost always higher than those to Lake Superior ports.

Not very much value is to be attached to a simple average of the rates of a season. The variations are so great as to render such an average very misleading.[3] To make the matter clear, resort will be had to a

[1] Marine Record, Vol. XX, No. 20, p. 9.

[2] These charges were reduced in 1897.

[3] The following table, giving the rates per ton on hard coal from Buffalo to Chicago, will show how great and frequent the variations are:

Week ending—	Cents.	Week ending—	Cents.	Week ending—	Cents.	Week ending—	Cents.
Apr. 25.....	40	June 27.....	50	Aug. 29.....	20	Oct. 31.....	30
May 2.....	40	July 4.....	50 to 40	Sept. 5.....	20	Nov. 7.....	30
9.....	40	11.....	40	12.....	20	14.....	30
16.....	50	18.....	40 to 30	19.....	20	21.....	30 to 40
23.....	50	25.....	30	26.....	20	28.....	60
30.....	50 to 60	Aug. 1.....	30 to 25	Oct. 3.....	20	Dec. 5 to close.....	60
June 6.....	60	8.....	20	10.....	20		
13.....	60 to 50	15.....	20	17.....	20 to 30		
20.....	50	22.....	20	24.....	30		

(*Report of* Buffalo Merchants' Exchange, 1896, p. 80.)

simple illustration. Suppose there were but two rates during a season, one 20 and the other 40 cents. A simple average for the season would be 30 cents. Under certain conditions this average would be very misleading. If 1,000,000 tons were carried for 20 cents per ton and but 100,000 for 40 cents per ton, an average of the rates actually paid would be much less than 30 cents per ton, namely, 21.81 cents. Where the variations in rates are very great, account must be taken of the quantities shipped as well as the rates; that is, a weighted average must be secured[1].

APPENDIX IV.

TABLE I.

Lake shipments of coal from Buffalo.

[Data furnished by William Thurstone, secretary Buffalo Merchants' Exchange.]

Year.	Anthracite.	Bituminous.	Blossburg.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*
1873	510,443	.....	60,000	570,443
1874	344,500	.....	40,000	384,500
1875	389,722	.....	50,000	439,720
1876	321,455	.....	40,000	361,455
1877	405,074	.....	50,000	455,074
1878	306,172	.....	25,000	331,172
1879	550,646	.....	30,000	580,646
1880	554,670	.....	35,000	589,670
1881	795,240	.....	30,000	825,240
1882	995,500	.....	32,000	1,027,500
1883	1,467,778	.....	.....	.....
1884	1,431,081	.....	.....	.....
1885	1,428,086	.....	20,000	1,448,086
1886	1,531,210	.....	10,000	1,541,210
1887	1,894,060	8,706	10,000	1,912,766
1888	2,514,906	7,452	5,000	2,527,358
1889	2,151,670	11,673	5,000	2,168,343
1890	2,157,810	25,872	5,000	2,188,682
1891	2,365,895	34,066	5,000	2,404,961
1892	2,822,230	54,216	5,000	2,881,446
1893	2,681,173	15,000	7,500	2,703,673
1894	2,475,255	2,500	7,500	1,485,255
1895	2,612,768	2,000	2,500	2,617,268
1896	2,379,068	15,000	6,000	2,400,068
1897	2,229,329	100,000	5,000	2,334,329

TABLE II.

Coal shipments, Cuyahoga customs district.

[Data furnished by F. A. Scott, assistant secretary Cleveland Chamber of Commerce.]

City.	1890.			1891.			1892.		
	Cargo.	Fuel.	Foreign.	Cargo.	Fuel.	Foreign.	Cargo.	Fuel.	Foreign
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cleveland	880,121	275,358	131,698	989,044	417,696	114,919	1,154,058	437,941	136,832
Ashtabula	492,459	87,535	44,334	241,230	239,894	25,173	561,446	107,883	56,933
Lorain	298,444	1,500	16,914	273,036	160,776	16,701	352,000	5,649	27,509
Fairport	53,523	40,000	6,477	123,649	24,935	8,408	114,738	.....	.....
Total	1,724,544	404,393	199,423	1,626,959	843,301	165,201	2,182,242	551,473	221,274

[1] In order that a conception may be gained of the great variations in rates and the difference in rates from Lake Erie ports to the various upper lake ports, the rates on hard coal for the season of 1896 from Buffalo to the leading receiving ports will be given in Appendix IV, Table XI.

Coal shipment, Cuyahoga customs district—Continued.

City.	1893.			1894.		
	Cargo.	Fuel.	Foreign.	Cargo.	Fuel.	Foreign.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cleveland	1,095,567	252,606	174,384	807,507	205,857	104,530
Ashtabula	634,600	72,474	80,579	533,672	74,413	71,036
Lorain	506,723	7,045	26,426	327,805	8,788	20,025
Fairport	208,014	.....	2,376	290,787	.....	750
Conneaut	13,886	.....	.....	88,265	2,642	758
Total	2,458,790	332,125	283,765	2,048,036	291,700	197,099

City.	1895.			1896.		
	Cargo.	Fuel.	Foreign.	Cargo.	Fuel.	Foreign.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons*	*Tons.*
Cleveland	833,968	291,656	153,003	1,295,254	293,718	214,737
Ashtabula	665,365	209,443	104,391	623,212	411,604	70,731
Lorain	262,698	18,543	13,816	316,076	838	15,248
Fairport	209,080	15,000	.....	398,717	.....	.....
Conneaut	89,530	12,000	69,831	58,136	12,006	153,368
Total	2,060,641	546,642	341,041	2,691,395	718,166	454,084

City.	1897.		
	Cargo.	Fuel.	Foreign.
Cleveland	1,442,702	365,751	219,240
Ashtabula	751,289	200,508	60,961
Lorain	195,000	47	35,742
Fairport	185,318	.....	.....
Conneaut	28,970	1,333	126,384
Total	2,603,279	567,639	453,952

TABLE III.

*Summary of coal shipments from Cuyahoga customs district.**

Year.	Cleveland.	Ashtabula.	Lorain.	Fairport.	Conneaut.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1886	.....	.....	.....	.....	.....	1,079,784
1887	703,506	.....	.....	.....	.....	1,433,035
1888	1,000,000	.....	.....	.....	.....	1,855,260
1889	† 825,030	† 489,585	† 273,671	† 59,438	.....	2,020,996 † 1,647,724
1890	1,287,177	624,328	316,858	100,000	.....	2,328,360
1891	1,521,659	506,297	450,513	156,992	.....	2,635,461
1892	1,728,831	726,262	385,158	114,738	.....	2,954,989
1893	1,522,557	787,653	540,194	210,390	13,886	3,074,680
1894	1,117,894	679,121	356,618	291,537	91,665	2,536,835
1895	1,278,627	979,199	295,057	224,080	171,363	2,948,324
1896	1,803,709	1,105,547	332,164	398,717	223,510	3,863,645
1897	2,027,693	1,012,758	230,789	185,318	256,687	3,613,245

*Shipments from Cleveland for 1887–88 include small quantities of bituminous coal shipped by rail. The figures were obtained from seventeenth annual Report of the United States Geological Survey, Part III, pp. 343, 344. The totals of the district for 1886–87 were obtained from Ibid., p. 344. The dagger indicates census figures of Eleventh Census, Transportation Business, Part II, p. 316. The remainder of the table is a summary of the preceding table.

TABLE IV.

*Table showing the tonnage of lake coal shipped from Ohio, West Virginia, Maryland, and Pennsylvania mines during 1896, also the variety, and how it was distributed.**

Lake ports.	Pennsylvania.		Ohio.	West Virginia.	Maryland.
	Anthracite.	Bituminous.	Bituminous.	Bituminous.	Bituminous.
Buffalo, N. Y	2,683,560	882,062			
Erie, Pa	492,162	184,933			
Conneaut, Ohio		291,178			
Ashtabula, Ohio		1,037,242			
Fairport, Ohio		396,491		12,178	1,638
Cleveland, Ohio		1,433,790	104,587	38,206	
Lorain, Ohio			137,235		
Huron, Ohio		92,905	106,528	57,626	
Sandusky, Ohio			271,033	10,313	
Toledo, Ohio		19,214	647,652	40,789	
Total	3,175,722	4,337,815	1,267,035	159,117	1,638

Lake ports.	Foreign ports.		Domestic ports.		Fuel for vessels.	Total amount of lake tonnage.
	Anthracite.	Bituminous.	Anthracite.	Bituminous.		
Buffalo, N. Y	283,492	682,062	2,400,068		200,000	3,565,622
Erie, Pa	1,001	2,311	491,161	48,504	134,118	677,095
Conneaut, Ohio		200,612		61,010	29,556	291,178
Ashtabula, Ohio		71,781		840,502	124,959	1,037,242
Fairport, Ohio				354,579	55,728	410,307
Cleveland, Ohio		110,729		1,179,570	286,284	1,576,583
Lorain, Ohio		15,248		120,871	1,116	137,235
Huron, Ohio		869		244,135	12,055	257,059
Sandusky, Ohio		6,220		257,811	17,320	281,351
Toledo, Ohio		22,308		629,763	55,584	707,655
Total	284,493	1,112,140	2,891,229	3,736,745	916,720	8,941,327

Total lake shipments, 8,941,327 tons.
Total lake shipments (bituminous coal), 5,765,605 tons.
Shipped to foreign ports (anthracite and bituminous coal), 1,396,633 tons; to domestic ports, 6,627,974 tons.

*This table was furnished by R. M. Haseltine, chief inspector of mines of Ohio. I fear these figures are very inaccurate; for instance, the shipments of bituminous coal from Buffalo could not have been so large as reported.

TABLE V.

*Shipments of coal from lake ports from 1890 to 1896 inclusive.**

Lake ports.	1890.	1891.	1892.	1893.	1894.	1895.	1896.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Buffalo, N. Y	2,044,134	2,365,895	2,852,330	2,703,673	2,485,255	2,620,768	3,565,622
Erie, Pa	129,304	586,990	567,028	625,023	711,928	727,184	677,095
Conneaut, Ohio				23,184	89,023	166,073	291,178
Ashtabula, Ohio	452,394	386,375	726,267	787,653	669,735	998,772	1,037,242
Fairport, Ohio	63,360	66,914	114,738	234,089	300,923	325,064	410,307
Cleveland, Ohio	922,536	1,016,487	1,728,831	1,512,308	997,513	1,055,480	1,576,583
Lorain, Ohio	227,181	288,811	351,168	526,405	303,690	277,660	137,235
Huron, Ohio	150,000	200,000	240,000	227,444	213,595	208,000	257,059
Sandusky, Ohio	271,540	157,571	157,515	195,276	261,363	223,134	281,351
Toledo, Ohio	940,000	947,288	858,935	938,533	836,232	716,099	707,655
Total	5,200,449	6,016,331	7,596,812	7,773,588	6,869,257	7,318,234	8,941,327

*This table was furnished by R. M. Haseltine.

TABLE VI.

*Receipts of coal at Chicago by lake and rail (net tons).**

Year.	Anthracite.		Eastern bituminous.	
	Lake.	Rail.	Lake.	Rail.
	Tons.	*Tons.*	*Tons.*	*Tons.*
1872	495,765	.....	90,820	.....
1873	538,837	.....	199,107	.....
1874	404,383	.....	257,200	.....
1875	474,812	.....	273,894	.....
1876	373,146	.....	338,426	.....
1877	446,046	.....	358,713	.....
1878	325,553	.....	404,447	.....
1879	464,360	.....	282,469	.....
1880	457,317	.....	288,987	.....
1881	545,312	.....	288,161	.....
1882	663,785	447,636	287,794	390,212
1883	738,723	506,688	214,488	630,914
1884	820,002	627,806	243,188	612,462
1885	741,866	613,054	206,817	790,169
1886	768,164	616,997	166,762	888,771
1887	853,158	845,386	123,221	1,196,324
1888	1,242,044	702,737	115,862	1,049,372
1889	1,283,811	408,514	53,684	803,552
1890	1,236,021	346,101	40,766	780,249
1891	1,310,347	543,538	.....	976,816
1892	1,475,237	649,826	.....	1,218,616
1893	1,424,853	668,767	.....	1,393,614
1894	1,277,191	528,351	.....	1,061,211
1895	1,269,512	519,685	.....	872,198
1896	1,319,693	641,000	.....	913,311
1897	1,233,771	542,629	.....	1,174,231

*Reports of the Chicago Board of Trade down to but not including 1882. The receipts by lake are based upon the custom-house records; the receipts by rail are furnished by the railroad companies. From 1882 to 1895 (inclusive of both dates) the figures were obtained from Mineral Resources of the United States; the statements were furnished by the Chicago bureau of coal statistics and are vouched for as accurate. Bituminous receipts by rail since 1890 include receipts by both lake and rail of Pennsylvania, Ohio, West Virginia, and Kentucky coal; lake receipts are now very small and are not kept separate by the Chicago bureau of coal statistics. Receipts for 1896 and 1897 were furnished to me directly by this bureau.

TABLE VII.

*Receipts of coal at Milwaukee by lake and rail.**

Year.	Lake.	Rail.	Total.	Year.	Lake.	Rail.	Total.
	Tons.	*Tons.*	*Tons.*		*Tons.*	*Tons.*	*Tons.*
1861	31,608	.....	.....	1880	300,245	68,323	368,568
1862	24,860	.....	.....	1881	450,005	100,022	550,027
1863	42,313	902	43,215	1882	510,493	83,349	593,842
1864	44,503	.....	.....	1883	550,861	61,723	612,584
1865	36,369	.....	.....	1884	623,018	81,148	704,166
1866	66,616	.....	.....	1885	710,736	65,014	775,750
1867	74,568	.....	.....	1886	714,242	45,439	759,681
1868	92,992	.....	.....	1887	724,594	118,385	842,979
1869	87,690	.....	.....	1888	961,164	161,989	1,123,153
1870	122,865	.....	.....	1889	907,743	72,935	980,678
1871	175,526	.....	.....	1890	903,659	92,999	996,658
1872	210,194	.....	.....	1891	1,006,656	149,377	1,156,033
1873	229,784	.....	.....	1892	1,210,865	163,549	1,374,414
1874	177,655	11,082	188,737	1893	1,117,448	132,284	1,249,732
1875	228,674	15,962	244,636	1894	1,229,310	107,736	1,337,046
1876	188,444	11,957	200,401	1895	1,336,603	109,820	1,446,423
1877	253,640	11,144	264,784	1896	1,487,483	100,312	1,587,795
1878	237,332	3,658	239,667	1897	1,492,278	9,299	1,501,577
1879	325,281	25,559	350,840				

*Compiled from the annual reports of the Milwaukee Chamber of Commerce. Lake receipts are based upon the custom-house records.

TABLE VIII.

*Receipts of coal at Duluth and Superior.**

Year.	Anthracite.	Bituminous.	Total.	Year.	Anthracite.	Bituminous.	Total.
	Tons.	*Tons.*	*Tons.*		*Tons.*	*Tons.*	*Tons.*
1878			31,000	1888			1,535,000
1879				1889			1,205,000
1880			60,000	1890			1,780,000
1881			163,000	1891			1,776,000
1882			260,000	1892	531,547	1,281,014	1,812,561
1883			420,000	1893	571,915	1,554,866	2,126,781
1884			372,000	1894	562,222	1,448,509	2,010,731
1885			592,000	1895	489,495	1,165,387	1,654,882
1886			736,000	1896	496,169	1,279,523	1,775,712
1887			912,000				

* Down to 1892 the statements were compiled from the annual reports of the Duluth Board of Trade; from 1891 the receipts were obtained from the Review of the Trade and Commerce of Duluth, compiled by the Duluth Chamber of Commerce, for year ending December 31, 1896, p. 9. The statements of the Duluth Board of Trade are based on the custom-house records; those of the Chamber of Commerce were furnished by the coal companies.

TABLE IX.

*Average of daily lake rates on hard coal from Buffalo to Chicago, Duluth, and Toledo.**

Year.	Chicago.	Duluth.	Toledo.	Year.	Chicago.	Duluth.	Toledo.
1886	$0.87	$0.62		1892	$0.59	$0.43	$0.27
1887	1.05	.70	$0.35	1893	.49	.29	.28
1888	.86	.65	.41	1894	.46	.25	.25
1889	.52	.41	.27	1895	.59	.24	.30
1890	.62	.43	.33	1896	.36	.24	.25
1891	.56	.29	.25	1897	.29	.26	

* Prepared by The Marine Review, of Cleveland. Rate to Milwaukee about 2½ cents less than Chicago and Detroit rate about the same as, Toledo rate. Coal of all kinds shipped in net tons, and handled without charge to vessel.

TABLE X.

*Averages of daily rates on soft coal from Ohio ports to Milwaukee, Escanaba, Duluth, Green Bay, and Manitowoc.**

Year.	Milwaukee.*a*	Escanaba.	Duluth.	Green Bay.	Manitowoc.
1886	$0.83	$0.60	$0.78		
1887	1.06	.72	.89		
1888	.84	.61	.66		
1889	.54	.49	.52		
1890	.64	.45	.49		
1891	.61	.52	.49		
1892	.58	.43	.43	$0.55	$0.49
1893	.48	.40	.38	.50	.41
1894	.485	.39	.375	.495	.48
1895	.54	.39	.365	.50	.51
1896	.335	.27	.295	.325	.32
1897	.28½	.29½	.26	.30	.31

* Prepared by The Marine Review, of Cleveland, Ohio.
a Chicago rate about the same as Milwaukee.

TABLE XI.

*Lake freights on hard coal from Buffalo to Chicago and other ports in 1896.**

Week ending—	Chicago.	Milwaukee.	Duluth and Superior.	Gladstone.	Toledo.	Detroit.
Apr. 25	40	40	25	.....	25	.....
May 2	40	40	25	.....	25	.....
9	40	40	25	.....	25	.....
16	50	40 to 50	25	25	.....	.....
23	50	45	25	.....	.....	.....
30	50 to 60	45 to 55	25	.....	.....	.....
June 6	60	55	25	25	25	.....
13	60 to 50	55 to 45	30	.....	.....	.....
20	50	45	30	35	25	.....
27	50	45	30	.....	.....	.....
July 4	50 to 40	45 to 35	30 to 25	.....	25	.....
11	40	35	25	.....	.....	.....
18	40 to 30	25 to 30	25	.....	25	.....
25	30	30	25	25	25	.....
Aug. 1	30 to 25	30 to 25	25	25	25	.....
8	20	20	20	20	20	.....
15	20	20	20	20	20	25
22	20	20	20	20	20	.....
29	20	20	20	20	20	.....
Sept. 5	20	20	20	20	20	.....
12	20	20	20	20	20	20
19	20	20	20	20	20	.....
26	20	20	20	20	20	.....
Oct. 3	20	20	20	.....	20	.....
10	20	20	20	20	25	.....
17	20 to 30	20 to 30	20	30	25	.....
24	30	30	20	30	25	25
31	30	30	20	20	25	25
Nov. 7	30	30	20	20	25	.....
14	30	30	20	20	25	.....
21	30 to 40	30 to 40	30	30	25	.....
28	60	60	50	50	30	.....
Dec. 5 to close	60	60	50	.....	.....	.....

* This statement shows the ruling freight rates on coal per net ton, in cents, from Buffalo to the ports named during the season of 1896 for the weeks ending on the dates specified. Coal is handled without charge to the vessel. (Report of Buffalo Merchants' Exchange, 1896, pp. 80, 81.)

TABLE XII.

*Shipments of coal from Chicago.**

Year.	Anthracite.	Bituminous.	Total.
	Tons.	*Tons.*	*Tons.*
1883	493,860	.....	.....
1884	585,753	.....	.....
1885	632,274	.....	.....
1886	451,869	539,184	991,053
1887	559,560	1,001,477	1,561,037
1888	598,707	872,631	1,471,338
1889	502,865	703,743	1,206,608
1890	576,665	951,678	1,528,343
	553,245	824,349	1,377,594
1891	606,709	737,346	1,344,055
1892	659,942	815,682	1,475,624
1893	682,277	719,382	1,401,659
1894	452,967	515,165	968,132
1895	377,710	621,598	999,308
1896	319,791	593,786	913,577
1897	236,271	583,415	819,686

*Down to 1896 the figures were obtained from the Mineral Resources of the United States. The figures for 1890 given in Mineral Resources for 1891, p. 195, differ from those given in Mineral Resources 1889–90, p. 160. The lower figures are, I believe, the corrected ones. These figures were furnished by the Chicago Bureau of Coal Statistics. The figures for 1896 were furnished to me directly by this bureau. Shipments of bituminous coal down to, but not including, 1895 included coke. Shipments of coke amounted to 279,874 tons in 1895, and 325,362 tons in 1896.

TABLE XIII.

Shipments of coal from Milwaukee.a

Year.	Net tons.	Year.	Net tons.	Year.	Net tons.	Year.	Net tons.
1871	22,960	1878	61,041	1885	269,277	1892	469,144
1872	24,872	1879	58,560	1886	284,803	1893	532,993
1873	26,515	1880	66,390	1887	295,439	1894	432,768
1874	27,619	1881	121,885	1888	453,837	1895	640,470
1875	39,172	1882	164,444	1889	413,408	1896	446,683
1876	44,408	1883	235,771	1890	522,618		
1877	63,025	1884	205,061	1891	660,888		

a Compiled from the annual reports of the Milwaukee Chamber of Commerce.

PART V.

THE LUMBER BUSINESS AND LAKE TRANSPORTATION.

Of the commodities carried in large quantities upon the Great Lakes, lumber alone remains to be treated. The lumber traffic, in striking contrast with the ore, coal, and the flour and grain business, is waning.[1] Because of the meagerness of data, the total movement of forest products on the lakes can not be presented for a series of years. That there has been a falling off in the movement of this important commodity is, however, clearly shown by the receipts of lumber by lake, at the great lumber marts of Chicago, Milwaukee, Buffalo, Tonawanda, Cleveland, Toledo, and Detroit.[2]

The decline in the movement of forest products on the Great Lakes is largely due to the destruction of forests of white and Norway pine on the shores of the lakes and on the banks of the logging streams flowing into the lakes. The enormous drafts that have been made during half a century upon the once seemingly unlimited supplies of Michigan, Wisconsin, and Minnesota have in recent years well nigh exhausted the forests near the lakes and on the banks of the streams capable of floating logs. Stream after stream has sent down its last logs. The mills at Saginaw and at other points on the Huron shore of the lower peninsula of Michigan are now in a large measure supplied with logs rafted from the Georgian Bay district of Ontario.[3] The Kalamazoo, the Grand, the Betsie, and the Bear rivers of western Michigan have ceased to be logging streams, and the White, Muskegon, and the Père Marquette will soon join them. The Wolf River of Wisconsin, that once carried down large quantities of good factory pine,

[1] The statistics of this traffic are even more unsatisfactory than those of the coal business. It would be futile, therefore, to attempt to set forth the present volume, or the growth and decline of the total movement of lumber on the lakes. It is not surprising that the statistics of the lumber traffic should be unsatisfactory, for the products of the forest are numerous and varied and the lumber business is widely scattered and in many hands. A single unit of measurement usually promotes accuracy. Such a unit is impossible where the products are as diverse as posts, telegraph poles, shingles, and lumber. Some unit of weight might be selected, but lumber is not bought and sold by weight, and if weight were used as a basis of measurement no idea of bulk would be conveyed, for there is vast difference in the weight of dry and green lumber.

[2] For the receipts of these cities, see Appendix V, Tables I–VII. There is no reason for inferring that the aggregate receipts of these ports now form a less proportion of the total receipts of the lake ports than formerly.

[3] It is estimated that the following importations of logs were made during 1896, a poor year in the lumber business:

	Feet.
At Saginaw	146,338,400
At Detroit	20,269,000
At East Tawas	19,680,000
At Alpena	27,472,446
At Cheboygan	40,000,000
Total	253,759,846

Marine Review, Jan. 7, 1897, p. 13.)

will soon float no logs, and the cut of timber in the Green Bay shore district is on the decline.

With the depletion of the forests of white and Norway pine contiguous to the lakes and near the rivers flowing into the lakes, the transportation situation has been radically altered. As the lumbermen have been forced to go farther and farther into the interior, the railroads have found it correspondingly easier to compete with the lake carriers. This has followed because in a great many cases it has not paid to haul the logs to the logging streams flowing into the lakes or to transport them directly to the mill at the lake side. The former plan has also been growing in disfavor for other reasons. Logs in some districts now have considerable value and a good many are lost in floating them to the mills. Then, too, there may be delays in driving the logs because of ice or a lack of water. Now, as the cost involved in moving the logs from the remote districts to the lake shore is often sufficient to prevent such movement, the logs are sawed at mills located at interior points. From these interior mills the lumber generally goes to market by rail, for the cost of shipping by the combined rail-and-water route with its charges for transshipment is greater than that by the all-rail lines.

There are also other factors that make it advantageous to ship by the all-rail lines from the interior mills. The railroads have better terminals in the large ports. This factor is often of sufficient importance to determine whether lumber is to go by the all-rail or lake-and-rail lines. With the rapid increase of the population of many of the lake cities, the local trade has grown wonderfully, and in some instances now exceeds the out-of-town or wholesale business.[1] The growth of the retail business is of significance, because it necessitates the delivery of lumber to localities remote from the docks. To avoid the large expense involved in the cartage, lumber yards are established in the outlying districts and suburbs. These yards find it advantageous to receive their stocks directly by rail, particularly where there is no extra charge for switching. In cities covering a vast extent of territory, the cost of delivering bulky articles, such as coal and lumber, by team from a central point, often forms a large proportion of the price paid for the commodities. It is therefore highly desirable to carry such commodities as near the point of consumption as possible by cheaper means of transportation. The railroads furnish this economical form of carriage.

Transportation by rail has still other points in its favor. An order for a special class of lumber can be sent to a mill or scattered among different mills and readily filled. It is unnecessary to purchase a whole shipload of one or more kinds of lumber in order to lay in a stock of a certain class. Then, too, the lumber comes to the yard on cars, from which it can be easily handled. To a large extent it can be taken directly to the consumer from the car, thus avoiding the expense of movement in the yard and piling. Often all the expense and delay incident to handling lumber in the yard at the distributing point is obviated, for the cars can be rebilled to the country dealer. It thus appears that shipment by rail has three distinct advantages to offer: (1) expedition; (2) economy of labor in handling; (3) the dealer can obtain just what he wants and no more, and thus is not forced to unbalance his stock, as he is obliged to do when buying by the cargo. During the winter the railroads frequently move large quantities of lumber.

[1] An examination of Table I, Appendix V, will show the extent of the local consumption in Chicago. In 1897, the receipts of lumber aggregated 1,406,580 M. feet, while the shipments were but 574,743 M. feet, or very much less than one-half the receipts.

Certain classes of lumber in the yards become exhausted, and, as there are no boats moving, stocks must be replenished by rail; or the demand may be greater than was expected, making necessary accessions by rail.

Altered methods of doing business at the mills also in part explain the greater rail movement. It is becoming the custom to sort lumber where it is sawed, and it is therefore possible to fill orders of consumers and country dealers directly from the mills. These consignments generally go by rail. Formerly the sorting was done by the wholesalers at the great distributing centers about the lakes, who bought supplies by the cargo and often made a large portion of their profits by a nice manipulation of the mixed stocks received. This revolution in handling lumber has worked itself out very fully on the Saginaw River, and a description of the change, in the words of Mr. E. D. Cowles, will be inserted:

A few years ago the manufacturer, with hardly an exception, sold his product by the cargo, and it was shipped by water to other cities, where the finer manipulation of the stock made business for large capital and armies of mechanics and laborers. Now the manufacturer sorts his stock and sells it in car lots as wanted by the consumer. In other words, he combines the business of wholesaler with that of the retailer, and this accounts in large measure for the falling off in lake shipments. Local dealers who do not operate manufacturing plants also have established yards and buy lumber at interior points in the State and on this river, sort it up or convert it into box material or plain stock, and ship it out by rail to their consumers.

The extent of the change in the kind of transportation employed in moving the lumber of the Saginaw River to market is made clear by the subjoined table:

Lake and rail shipments of lumber from Saginaw River points. *

Year.	Rail.	Lake.	Year.	Rail.	Lake.
	Feet.	*Feet.*		*Feet.*	*Feet.*
1885	149,672,900	659,565,000	1892	427,490,000	347,866,091
1886	176,500,000	591,013,100	1893	369,000,000	173,154,000
1887	261,900,000	486,285,000	1894	381,450,000	182,600,017
1888	304,362,500	451,391,000	1895	393,527,000	136,120,632
1889	352,500,000	432,130,000	1896	280,572,500	68,743,000
1890	401,847,000	409,972,000	1897	379,000,000	89,137,511
1891	408,258,000	404,577,000			

* The lumber manufacturing district of the Saginaw River is a narrow strip of land less than half a mile wide and 18 miles long. Within this area there has been manufactured a larger amount of lumber than in any other district of equal area in the world. Since 1851, 22,943,072,900 feet of lumber have been cut. The rail shipments for 1897 are estimated. The table was compiled by E. D. Cowles and is worthy of confidence.

Perhaps the ultimate destination of the lumber has in part changed during the period covered by the table, so that the lake carriers are not in so favorable a position to compete for it as formerly. Upon this point no information is at hand.

In some of the great lumbering districts the mills are now kept running during a large portion of the year on hard wood. The total output of the districts about the Great Lakes is in part maintained in this way. During 1897, 464,380,000 feet of hard-wood lumber were produced.[1]

The change from pine to hard wood is of great significance, for hard-wood logs are so heavy that they do not float; and they are therefore generally sawed at interior mills. It has already been pointed out that the lake carriers are at a disadvantage in competing with the railroads from the interior mills, for the local rail rates to the shipping ports are high and the lumber must be transshipped.

[1] Northwestern Lumberman, January 22, 1898, p. 10.

Before closing the discussion of the declining movement of lumber on the lakes, something must be said about the methods of transshipment. Too much attention can not be given to this subject, for it may in a general way be said that the railroads are competing most successfully for those commodities whose transshipment charges have not fallen rapidly.[1] The necessity of transfer has always been a handicap upon the lake carriers, and where the cost of transshipment has not fallen as freight rates[2] have fallen this burden has been an increasing one. It may be said, almost without qualification, that no improvements have been made in handling lumber on the docks. Everything is now done, as it was a half century ago, by main strength. Practically all the work is accomplished by manual labor. Machinery is used to a very limited extent in hoisting posts and ties from the ship's hold, but lumber is still handled in the primitive way.

The absence of mechanical appliances for handling forest products is no doubt largely due to the fact that most of these products do not readily lend themselves, by reason of their form, to mechanical manipulation. However, the difficulties to be overcome do not appear to be insuperable, and if the lumber traffic on the lakes were a growing instead of a declining business, and in the hands of large companies with abundant capital, it would be safe to predict that a way would be found to reduce the cost of transshipment by the larger use of machinery. It would be profitable, if a large volume of business were to be handled, to expend large sums upon suitable terminal facilities. Perhaps, in order to accomplish this end, some changes would have to be made in the vessels, but these would be introduced. The explanation of the persistence of the primitive methods of handling lumber is found in the fact that the lumber traffic on the lakes is declining, and that the same companies seldom own the mills, fleets, and distributing yards. The greatest economy in transshipment is found where the terminals and the fleets are adapted to each other, and this adaptation is most easily secured where entire control rests in one management.

A treatment of the lumber traffic upon the lakes would not be complete without some description of the lumber fleet. It is very largely made up of vessels that are worthless for other purposes. When a ship is no longer suitable for the ore or flour and grain traffic, it is put into the lumber business, where it is good for a number of years of service. This follows from the fact that a vessel loaded with lumber, although water-logged, does not sink, and because the cargo sustains but little damage from its contact with the water. Many of the small vessels on the lakes are in the lumber business. They can navigate the rivers that are too shallow for the large vessels. Most of the vessels of the old schooner fleet have been transformed into barges and are now engaged in the lumber traffic. Towing originated in the lumber trade. Mr. John S. Noyes, of Buffalo, was the pioneer who made this important departure. When the railroads were pushed westward to the principal lake ports, in the early fifties, the fine passenger and general cargo steamers that were then numerous upon the lakes lost a profitable business. In 1861, Mr. Noyes transformed two of these ships, which had long been idle, into barges. These vessels were the *Empire* and the *Sultana*. In 1862, he changed another vessel (the *St. Lawrence*) into a barge.[3] These barges were towed by the tug

[1] For loading and unloading charges, see Appendix V, Table VII.
[2] For freight rates, see Appendix V, Table VIII.
[3] Barges were at first called "Tows."

Reindeer. Mr. Noyes's venture proving successful, towing increased rapidly, and about 1870 another important innovation was made; the tugs were supplanted by a propeller, which also carried a cargo.[1]

It has already been stated that the movement of lumber on the lakes has been declining. Before many years it may be expected to fall off rapidly. Pine must continue to be, as it has been in the past, the main reliance of the vessel owners. The supplies that can be drawn upon are about as follows:

White and Norway pine:[2]	Feet.
Lower peninsula of Michigan	3,000,000,000
Upper peninsula of Michigan	4,000,000,000
Wisconsin	10,000,000,000
Minnesota	12,000,000,000
Province of Ontario	19,404,000,000

Mr. Andrews, chief fire warden of Minnesota, estimates that there are 20,266,475,000 feet of pine still standing in Minnesota,[3] and others have raised his estimate. The authorities also differ on the amount of standing timber in Wisconsin and Michigan, but their estimates do not vary so widely as in the case of Minnesota. This is to be expected, for the resources of Michigan and Wisconsin are well known, while those of Minnesota are comparatively unknown.

As the output of pine lumber from logs cut in Michigan, Wisconsin, and Minnesota during 1897 was nearly 6,000,000,000 feet, and in prosperous years has exceeded 8,000,000,000,[4] it will readily be seen that the timber resources of these states will soon be exhausted.[5] With the depletion of the timber supplies of Michigan, Wisconsin, Minnesota, and the Province of Ontario, the movement of lumber on the lakes will lose its present importance.[6]

In addition to the pine, there is a vast amount of hemlock and hard wood standing in Michigan and Wisconsin and a limited quantity in Minnesota.[7] A portion of the lumber sawed from this timber will be carried to market by water. But the bulk of the hard-wood lumber will be transported by rail, for reasons that have already been given. Hemlock logs can be floated to the lake-side mills, but a large portion, perhaps the lion's share, of the hemlock will be taken to market by rail, for the good timber has already been stripped from the lake side and the banks of the streams. The better growths of hemlock are now sit-

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[1] For this historical information I am indebted to Mr. George W. Hotchkiss, who assisted Mr. Noyes in pushing his enterprise to success.

[2] The estimates for Michigan, Wisconsin, and Minnesota are those of Mr. George W. Hotchkiss, and the estimate for Ontario is that given in the Report of the Forest Wealth of Canada, 1895, p. 182. It is to be noted that all statements covering the amount of standing timber are in the nature of things merely estimates. Those here given are, however, made by persons well informed about the timber resources of these districts.

It must not be inferred that all the lumber cut from this timber may be carried over the lakes. Much of it is so far removed from the lake shore that it will go to market by rail.

[3] Northwestern Lumberman, July 3, 1897, p. 3.

[4] For the lumber cut at the mills of the Northwest since 1873, see Appendix V, Table IX. The figures just given include the output of lumber sawed from logs imported from Ontario.

[5] The fear of forest fires and windstorms in a measure prevents the owners of timber from reserving it for the future.

[6] In recent years there has been some traffic in Pacific-coast lumber and shingles. This business will probably increase, but would be checked by the construction of the Nicaragua Canal.

[7] According to the estimates made by Mr. George W. Hotchkiss the hemlock of Michigan and Wisconsin combined exceeds the pine of these two states, and the hard wood exceeds the pine several fold.

uated well back from the logging streams, and the logs are therefore likely to be sawed at the interior mills and the lumber taken to market by rail.

Estimates of the amount of standing pine in the states contiguous to the lakes have been given. A prediction as to the inroads that will be made into this supply during five years of active demand has been ventured by the Northwestern Lumberman, and will be inserted:

> The pine of lower Michigan and the upper peninsula of that State will be well nigh gone [in five years]. A few of the old-mill concerns at Menominee-Marinette will still be sawing pine, but the majority will either have dismantled their mills or will be keeping them alive by cutting hemlock and the hard woods and working up cedar for shingles. The mills at the lesser points will not be cutting pine five years from now. Pine production will have been driven back to the west end of Lake Superior and into northern Minnesota. The red oak of Wisconsin will have been about cleared out. Scattering mills throughout the northern country from the Mississippi to the Soo will be pounding away on maple, elm, bass wood, hemlock, etc., with such overlooked groups of pine as may be encountered in scraping the land of timber. * * * Five years of prosperity, with the enormous demand which will result, will cause such a melting away of the northern forest resources as can scarcely be realized.[1]

This picture may be somewhat overdrawn; but if the prediction made be verified forest products, which rank second among the commodities received at the lake ports during the last census year,[2] will fall out of the first rank and be classed with the minor commodities five years hence.

What may be hoped for from attempts to reforest the pine lands can not be answered satisfactorily, for on this point the authorities differ. Some hold that pine does not grow at once upon land from which pine has just been removed, and some admit that pine will grow, but that the first growths will be low, scraggy, and full of knots, and therefore unfit for the manufacture of lumber. Other authorities insist that good pine can at once be reproduced if (1) forest fires are prevented and (2) the young sprouts be preserved from the depredations of live stock. In support of their contention they cite the experience of New England. But even if it be possible to restore the pine it would require a long period of years for the trees to attain sufficient size for the manufacture of lumber, and in the meantime existing supplies would long have been exhausted.

Although the depletion of the forests of Michigan, Wisconsin, and Minnesota is of itself of great moment to the lake carriers, it becomes doubly important because of its secondary effect. For years the railroads running out from the upper lake ports to the prairies of the West have found in lumber a west-bound freight. Cars coming in with grain and live stock have been sent back loaded with lumber. Lumber has long

[1] Northwestern Lumberman, January 8, 1898, p. 3. Mr. O. S. Whitmore, formerly editor of Hardwood, and Mr. George W. Hotchkiss in the main agree with this prediction.

[2] In the last Census Report on Transportation by Water, coal and coke were grouped together, and their combined movement just about equaled that of lumber. The figures are as follows:

	Receipts.	Shipments.
	Tons.	*Tons.*
Lumber	6,857,257	5,348,398
Coal and coke	5,162,471	6,105,799

The receipts and shipments are the total receipts and shipments of all American lake ports. (Eleventh Census, Transportation Business, Part II, p. 308.)

been one of the principal west-bound commodities. Its loss, therefore, will be severely felt. The failure of the Northwestern timber supplies comes at a very inopportune time for the vessel interests of the lakes. The railroads running to the western Gulf ports are just beginning the struggle for the grain traffic of the central West. The exhaustion of the timber resources of the lake region means that the great treeless regions of the West will be forced in a large measure to obtain their lumber from the South.

This means that the north and south bound railroads will in the future be assured a growing north-bound traffic, and as a result they will be placed in a position where they can compete more successfully for the grain traffic with the east and west bound railroads leading to the lakes. In the past the Gulf railroads have been hampered by a lack of north-bound traffic, but in the future they will be assured a large north-bound business in lumber. Briefly stated, the exhaustion of the forests of the lake country will mean the loss of west-bound traffic to the railroads reaching the lakes and a gain of north-bound traffic by the railroads terminating in the Gulf ports. The former railroads will therefore be less advantageously situated in the struggle for the grain business now under way, and the latter railroads will be more strongly intrenched. The significance of these altered relations to the lake carriers scarcely needs to be pointed out. It means that less grain will arrive at lake ports to be carried East.

APPENDIX V.

TABLES RELATING TO THE LUMBER TRAFFIC.

TABLE I.

*Chicago receipts and shipments of lumber and shingles by lake and rail.**

Year.	Lumber.				Shingles.			
	Receipts by lake.	Receipts by rail.	Total receipts.	Shipments.	Receipts by lake.	Receipts by rail.	Total receipts.	Shipments.
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M.*	*M.*	*M.*	*M.*
1860	254,499	7,995	262,494	225,372	127,803	91	127,894	168,302
1861	235,668	13,640	249,308	189,479	79,296	60	79,356	94,421
1862	295,270	10,404	305,674	189,277	131,255	.....	131,255	55,761
1863 *a*	392,800	20,501	413,301	221,799	152,435	19,929	172,364	102,634
1864 *a*	480,165	21,427	501,592	269,496	133,600	56,569	190,169	138,497
1865 *a*	614,020	33,125	647,145	385,353	193,230	117,667	310,897	258,351
1866 *a*	687,851	42,206	730,057	422,313	197,169	202,956	400,125	422,339
1867 *a*	830,035	52,626	882,661	518,973	234,917	212,122	447,039	480,930
1868	965,860	62,634	1,028,494	551,989	297,176	217,258	514,434	537,497
1869	967,897	29,839	997,736	581,533	366,843	306,323	673,166	638,317
1870	979,759	39,239	1,018,998	583,490	350,561	301,530	652,091	666,247
1871	984,758	54,570	1,039,328	541,222	401,346	246,249	647,595	558,385
1872	1,017,319	166,340	1,183,659	417,980	302,623	308,201	610,824	436,827
1873	1,020,638	102,730	1,123,368	561,544	294,548	223,375	517,923	407,505
1874	993,751	66,337	1,060,088	619,278	365,490	215,183	580,673	370,196
1875	1,080,599	66,594	1,147,193	628,485	420,298	215,410	635,708	299,426
1876	971,416	68,369	1,039,785	576,124	456,404	110,573	566,977	214,389
1877	1,002,501	63,951	1,066,452	586,722	464,880	81,529	546,409	170,410
1878	1,093,088	87,498	1,180,586	626,735	605,941	86,603	692,544	123,233
1879	1,351,149	118,729	1,469,878	753,179	588,362	82,282	670,644	146,820
1880	1,419,974	141,805	1,561,779	925,682	583,340	66,206	649,546	134,375

*This table was compiled from the reports of the Chicago Board of Trade. The movements by lake are based upon the custom house records and the movements by rail were obtained directly from the railroad companies. The figures, particularly for the early years, do not reflect with the greatest accuracy the movement of lumber and shingles to and from Chicago. The limited receipts by the canal are included in the receipts by rail. In recent years a large amount of lumber has been received from the South by rail.

a Board of trade year, which ended three months after the calendar year.

Chicago receipts and shipments of lumber and shingles by lake and rail—Continued.

Year.	Lumber.				Shingles.			
	Receipts by lake.	Receipts by rail.	Total receipts.	Shipments.	Receipts by lake.	Receipts by rail.	Total receipts.	Shipments.
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M.*	*M.*	*M.*	*M.*
1881	1,657,823	221,099	1,878,922	999,572	772,584	91,331	863,915	185,334
1882	1,872,976	244,569	2,117,545	1,073,419	868,279	64,777	933,056	146,943
1883	1,685,719	224,191	1,909,910	1,064,816	1,103,841	55,411	1,159,252	91,718
1884	1,610,166	212,149	1,822,315	940,147	885,091	34,615	919,706	64,256
1885	1,504,186	240,706	1,744,892	818,474	744,191	51,057	795,248	55,654
1886	1,427,795	315,189	1,742,984	882,672	762,809	51,060	813,869	102,102
1887	1,457,173	422,995	1,880,168	941,636	647,153	40,517	687,670	72,286
1888	1,626,408	440,519	2,066,927	793,171	615,132	62,213	677,345	96,858
1889	1,447,399	462,044	1,909,443	739,767	557,201	76,364	633,565	158,488
1890	1,359,921	581,471	1,941,392	812,655	389,195	126,380	515,575	108,822
1891	1,359,315	686,103	2,045,418	865,949	228,589	75,306	303,895	99,855
1892	1,443,769	760,105	2,203,874	1,060,017	280,326	114,880	395,206	140,227
1893	955,280	645,397	1,600,677	719,254	153,764	85,811	239,575	219,715
1894	1,075,763	486,764	1,562,527	632,069	189,282	136,093	325,375	216,565
1895	1,073,847	564,283	1,638,130	773,983	147,206	205,107	352,313	298,835
1896	779,292	507,351	1,286,643	599,920	106,603	158,602	265,205	277,329
1897	917,212	489,368	1,406,580	574,743	198,781	176,718	372,499	251,208

TABLE II.

*Milwaukee receipts and shipments of lumber and shingles by lake and rail.**

Year.	Lumber.				Shingles.			
	Receipts—			Shipments.	Receipts—			Shipments.
	By lake.	By rail.	Total.		By lake.	By rail.	Total.	
	M. feet.	*M. feet.*	*M. feet.*	*M. feet.*	*M.*	*M.*	*M.*	*M.*
1860	30,124	.....	31,897	19,511	12,871	.....	12,315	8,897
1861	56,554	.....	56,554	25,439	19,601	.....	19,601	7,421
1862	38,858	.....	38,858	11,527	13,385	.....	13,385	4,969
1863	29,195	963	30,158	.....	7,971	.....	7,971	.....
1864	34,236	1,312	35,548	.....	3,327	.....	3,327	.....
1865	33,372	8,684	42,056	.....	2,589	.....	2,589	.....
1866	48,612	10,287	58,899	21,906	.....	.....	19,585	10,703
1867	64,804	22,595	87,399	32,890	.....	.....	23,319	17,188
1868	.....	.....	94,023	30,788	.....	.....	20,980	16,407
1869	.....	.....	72,383	23,913	.....	.....	25,928	17,658
1870	.....	.....	79,491	19,289	.....	.....	15,143	17,939
1871	.....	.....	85,892	21,811	.....	.....	31,318	10,323
1872	.....	.....	91,303	16,245	.....	.....	28,524	7,791
1873	128,368	7,649	136,017	29,791	23,259	69,974	93,233	24,097
1874	123,645	17,815	141,460	36,455	31,318	149,656	180,974	74,930
1875	106,067	26,309	132,376	35,305	11,030	193,348	204,378	132,484
1876	113,822	31,188	145,010	40,916	23,006	159,410	182,416	124,804
1877	118,675	23,208	141,883	.....	32,543	142,361	174,904	.....
1878	118,096	14,894	132,990	48,920	46,020	115,530	161,550	57,248
1879	156,125	24,597	180,722	51,049	42,039	118,372	160,411	67,167
1880	132,614	57,824	190,438	.....	31,447	101,249	132,696	.....
1881	135,590	81,450	217,040	65,880	35,853	151,272	187,125	128,094
1882	171,674	86,147	257,821	65,363	32,204	114,124	146,328	83,596
1883	145,807	79,661	225,468	68,313	39,317	132,336	171,653	100,485
1884	135,921	94,241	230,162	57,275	36,511	81,730	118,241	45,777
1885	149,156	89,101	238,257	43,631	42,128	48,090	90,218	36,325
1886	131,787	113,768	245,555	82,099	24,240	52,080	76,320	33,396
1887	151,751	147,368	299,119	117,258	10,920	58,700	69,620	52,500
1888	173,665	139,169	312,834	136,289	9,858	68,400	78,258	41,131
1889	148,201	161,509	309,710	144,846	23,093	93,200	116,293	59,100
1890	140,273	236,957	377,230	194,642	.....	.....	134,726	82,990
1891	176,184	184,942	361,126	174,388	26,296	81,600	107,896	79,300
1892	192,448	206,659	399,107	48,839	35,524	7,250	42,774	46,000
1893	167,360	137,976	305,336	52,752	17,125	3,574	20,699	8,090
1894	144,858	41,726	186,584	16,597	14,092	1,303	15,395	2,578
1895	145,809	51,773	197,582	21,505	5,827	1,455	7,282	4,400
1896	119,025	44,477	163,502	20,704	13,550	1,400	14,950	4,600
1897	150,332	39,045	189,377	19,186	10,061	1,400	11,461	3,100

*This table was compiled by W. J. Langson, secretary of the Milwaukee Chamber of Commerce. Receipts by lake are based upon the custom-house records, and receipts and shipments by rail were obtained from the railroad companies.

TABLE III.—PART 1.

*Receipts of lumber and shingles at Buffalo by lake and rail.**

[Furnished by Knowlton Mixer, secretary of the Buffalo Lumber Exchange.]

Year.	Lumber.			Shingles.		
	By lake.	By rail.	Total.	By lake.	By rail.	Total.
	M feet.	*M feet.*	*M feet.*	*M.*	*M.*	*M.*
1876	119,146	.....	.....	.....	.....	.....
1877	141,572	.....	.....	.....	.....	.....
1878	176,312	.....	.....	.....	.....	.....
1879	202,443	.....	.....	.....	.....	.....
1880	214,169	.....	.....	.....	.....	.....
1881	240,802	.....	.....	.....	.....	.....
1882	248,196	.....	.....	44,908	.....	.....
1883	233,433	.....	.....	37,302	.....	.....
1884	248,196	.....	.....	37,616	.....	.....
1885	240,637	.....	.....	52,716	.....	.....
1886	279,493	.....	.....	58,582	.....	.....
1887	264,612	.....	.....	36,705	.....	.....
1888	279,493	.....	.....	58,582	.....	.....
1889	242,525	.....	.....	36,331	.....	.....
1890	287,334	.....	.....	73,500	.....	.....
1891	262,729	.....	.....	44,905	.....	.....
1892	298,980	636,344	935,324	42,165	.....	.....
1893	286,751	587,482	874,233	50,807	.....	.....
1894	239,525	410,000	649,525	105,112	.....	.....
1895	231,257	398,448	629,705	92,588	.....	.....
1896	201,277	409,095	610,372	103,988	.....	.....
1897 (estimated)	221,302	426,870	648,172	110,401	12,800	123,201

* Lake receipts are based upon the custom-house records. The rail receipts are taken from the monthly reports of cars made to the freight bureau of the Merchants' Exchange by the various railroads. The imports and exports by rail are estimated from the number of cars obtained from the railroads, and therefore include shingles and laths.

TABLE III.—PART 2..

*Receipts of railway ties at Buffalo, by lake and rail.**

[Data furnished by Knowlton Mixer, secretary of the Buffalo Lumber Exchange.]

Year.	By lake.	By rail.	Year.	By lake.	By rail.
	No.	*No.*		*No.*	*No.*
1882	840,200	150,000	1890	197,110	150,000
1883	275,920	550,000	1891	238,570	139,000
1884	100,000	180,000	1892	312,500	411,520
1885	87,500	200,000	1893	253,000	175,000
1886	54,780	100,000	1894	196,117	275,000
1887	93,080	50,000	1895	133,928	263,500
1888	196,600	75,000	1896	199,044	190,800
1889	442,570	155,000	1897	328,052	.....

* Lake receipts are based upon the custom-house records. The rail receipts are taken from the monthly reports of cars made to the freight bureau of the Merchants' Exchange by the various railroads.

TABLE IV.

*Receipts of lumber, laths, and shingles at Tonawanda by lake.**

	Lumber.*a*	Laths.	Shingles.		Lumber.*b*	Laths.	Shingles.
	M feet.	*M.*	*M.*		*M feet.*	*M.*	*M.*
1887	501,536	10,096	68,435	1892	498,000	6,243	42,809
1888	569,522	14,617	64,903	1893	430,248	13,232	25,257
1889	676,017	11,506	68,712	1894	406,907	8,495	31,468
1890	717,650	13,039	52,232	1895	421,372	8,547	41,310
1891	505,512	8,209	52,561	1896	469,246	7,195	35,823

* Report of the Buffalo Merchants' Exchange, 1896, p. 119.
a Timber not included.

TABLE V.

*Receipts of lumber, shingles, laths, and miscellaneous lumber at Cleveland by rail and lake.**

	Lumber.			Shingles.		Laths.	
	By lake.	By rail.	Total.	By lake.	Total.	By lake.	Total.
	M feet.	*M feet.*	*M feet.*	*M.*	*M.*	*M.*	*M.*
1865	.....	.....	83,038	.....	39,294	.....	14,381
1866	.....	.....	120,911	.....	60,842	.....	26,650
1867	.....	.....	142,445	.....	69,816	.....	37,850
1868	.....	.....	158,220	.....	74,921	.....	42,021
1869	.....	.....	180,000	.....	91,888	.....	36,438
1870	158,866	.....	173,866	108,002	131,102	63,173	63,173
1871	220,584	.....	.....	115,819	.....	47,711	.....
1872	191,079	.....	.....	70,597	.....	41,562	.....
1873	192,448	.....	.....	81,919	.....	26,745	.....
1874	167,768	.....	.....	78,691	.....	41,538	.....
1875	140,980	.....	.....	78,945	.....	3,510	.....
1876	102,609	.....	.....	73,565	.....	34,318	.....
1877	154,144	.....	.....	112,280	.....	140,488	.....
1878	119,817	.....	.....	101,205	.....	31,796	.....
1879	208,393	.....	.....	125,112	.....	21,081	.....
1880	231,263	.....	.....	96,797	.....	19,461	.....
1881	321,130	.....	.....	112,142	.....	29,287	.....
1882	317,810	.....	.....	112,369	.....	34,457	.....
1883	350,696	.....	.....	102,430	.....	36,807	.....
1884	329,791	.....	.....	86,072	.....	31,273	.....
1885	.....	.....	.....	.....	.....	.....	.....
1886	.....	.....	.....	.....	.....	.....	.....
1887	.....	.....	.....	.....	.....	.....	.....
1888	.....	.....	.....	.....	.....	.....	.....
1889	.....	.....	.....	.....	.....	.....	.....
1890	495,984	.....	.....	60,998	.....	18,537	.....
1891	564,222	.....	.....	32,882	.....	24,598	.....
1892	714,476	.....	.....	152,733	.....	35,795	.....
1893	210,636	.....	.....	187,483	.....	36,324	.....
1894	247,078	130,545	377,623	56,826	.....	22,762	.....
1895	351,883	153,750	505,633	45,599	.....	12,199	.....
1896	244,765	187,275	432,040	54,709	.....	6,913	.....
1897	229,971	174,225	404,196	44,158	.....	16,413	.....

* The receipts of lumber by rail also include the receipts of shingles and laths. Lake receipts of lumber 1890–1897 include all kinds of forest products other than shingles and laths, as logs, posts, and telephone poles. Receipts by lake are based upon the custom-house reports.

TABLE VI.

*Receipts of lumber and shingles at Toledo by lake.**

Year.	Lumber.	Shingles.	Year.	Lumber.	Shingles.
	M feet.	*M.*		*M feet.*	*M.*
1880	197,011	15,505	1889	168,000	3,620
1881	225,350	8,597	1890	192,000	4,929
1882	218,000	3,838	1891	178,000	685
1883	224,000	12,600	1892	173,000	400
1884	216,000	9,400	1893	156,000	2,420
1885	230,000	10,100	1894	144,000	2,075
1886	160,000	2,500	1895	159,000	2,200
1887	182,000	6,100	1896	127,000	400
1888	335,000	4,200	1897	122,000	2,300

* This table was furnished by Denison B. Smith, secretary of the Toledo Produce Exchange.

TABLE VII.

*Receipts and shipments of lumber and shingles at Detroit by lake and rail.**

Year.	Lumber.				Shingles.			
	Receipts by lake.	Receipts by rail.	Total receipts.	Total shipments.	Receipts by lake.	Receipts by rail.	Total receipts.	Total shipments.
	M. feet.	*M. feet.*	*M. feet.*	*M. feet.*	*M.*	*M.*	*M.*	*M.*
1885	97,665	69,102	166,867	34,515	None.	30,712	30,712	20,999
1886	78,191	161,694	239,885	58,769	3,339	106,338	109,677	41,960
1887	95,752	206,895	302,647	36,858	560	37,670	38,230	44,100
1888	102,073	197,774	299,847	41,750	1,750	66,600	68,350	58,300
1889	113,277	185,404	298,681	63,753	2,385	117,530	120,365	82,390
1890	78,085	184,538	262,623	34,202	None.	116,270	116,270	36,120
1891	48,459	156,662	205,211	20,946	908	105,980	106,888	10,640
1892	54,789	194,180	248,969	26,641	752	96,950	97,702	8,330
1893	54,429	139,270	193,699	21,066	2,420	95,760	98,180	10,430
1894	49,935	83,860	133,795	16,970	400	63,070	63,470	7,350

* This table was compiled by the secretary of the Detroit Board of Trade.

Rates for unloading lumber from vessels at Chicago during the season of 1897.†

Pine lumber, per 1,000 feet:	
1-inch and 1½-inch	$0.20
1½-inch and 2-inch	.22
3-inch	.24
Pickets and shingles to rate with inch lumber.	
Piece stuff, per 1,000 feet	.22
Laths to rate with piece stuff.	
Timbers, per 1,000 feet	.28
Lumber and timber, 20 feet and over in length, 3 cents extra per 1,000 feet.	
Hemlock and basswood, per 1,000 feet:	
1-inch	.22
2-inch	.24
3-inch	.28
Hemlock timber	.30
Hard-wood lumber, per 1,000 feet:	
1, 1½, 1¼, and 2 inch	.28
3-inch	.32
4-inch	.36
Lumber half regular rate for all grades for keeping dock.	
All vessels carrying over 500,000 feet of lumber, per 1,000 feet extra for entire cargo	.05
Ties:	
Oak, per tie	.02
Hemlock, on vessels 10 feet deep and under in depth, each	.01¾
Hemlock, on vessels over 10 feet in depth, each	.02
Cedar, per tie	.01⅛
On Santa Fe dock	.01¼
Peeled posts, per 1,000	6.00
Bark posts, per 1,000	7.00
$2 extra per 1,000 for keeping dock.	
Telegraph poles, each:	
25-foot	.03
30-foot	.05
35-foot	.08
40-foot	.12

† Rates charged by the Unloaders' Union.

Rates for unloading lumber from vessels at Tonawanda during the season of 1897.[1]

The rate for unloading white and Norway pine from barges and steamers of 12½ feet in depth of hold, or less, Government register, was 22 cents per M until October 1, and 24 cents per M from October 1 until the end of the season. Other rates were:

		Cents.
Birch	per M..	35
Maple	do....	35
Ash	do....	35
Oak	do....	40
Basswood	do....	24
Elm	do....	26
Hemlock	do....	25
Bill timber	do..	30, 35, 40
Round cedar posts	each..	¼
Split posts	do....	¼
Cedar railroad ties	do....	1¼

TABLE VIII.

Freight rates on lumber (per 1,000 feet) from Alpena, Manistee, Menominee, Ashland, and Duluth, to Chicago by lake. *

Year.	Alpena.	Manistee.	Menominee.	Ashland.	Year.	Alpena.	Manistee.	Menominee.	Ashland.
1877	$1.31	$1.27	.....	.....	1888	$1.90	$1.49	$1.57	$2.73
1878	1.14	1.34	$1.46	.....	1889	1.59	1.42	1.40	2.42
1879	.....	1.77	1.87	.....	1890	1.74	1.58	1.66	2.51
1880	2.22	2.12	2.27	.....	1891	1.69	1.59	1.59	2.44
1881	.....	2.18	2.17	.....	1892	1.81	1.62	1.67	2.91
1882	1.92	1.78	1.80	.....	1893	1.61	1.46	1.48	2.36
1883	2.01	1.85	1.85	.....	1894	1.41	1.32	1.33	2.00
1884	1.74	1.70	1.59	.....	1895	1.36	1.22	1.27	2.18
1885	1.64	1.46	1.54	.....	1896	1.16	1.14	1.20	1.85
1886	1.89	1.58	1.66	$2.12	1897	1.18	1.13	1.10	1.67
1887	2.53	1.94	2.11	3.15					

*The rates from Duluth, Superior, and the other ports at the head of Lake Superior are almost always the same as those from Ashland. This table is based on the weekly rates published by the Northwestern Lumberman, which takes great pains to have its quotations correct.

TABLE IX.

Production of lumber in the Northwest. *

Year.	M. feet.	Year.	M. feet.	Year.	M. feet.	Year.	M. feet.
1873	3,393,780	1880	5,651,295	1887	7,757,916	1894	6,763,110
1874	3,751,306	1881	6,768,856	1888	8,388,716	1895	7,093,398
1875	3,968,553	1882	7,552,150	1889	8,305,833	1896	5,538,112
1876	3,879,046	1883	7,624,789	1890	8,664,504	1897	6,233,454
1877	3,595,333	1884	7,935,033	1891	7,943,137		
1878	3,629,472	1885	7,053,094	1892	8,902,748		
1879	4,806,943	1886	7,425,368	1893	7,599,748		

*This table includes the lumber produced from the logs cut in Michigan, Wisconsin, and Minnesota, and from logs imported from Ontario and sawed in Michigan or at Lake Erie ports. Logs from Minnesota and Wisconsin are floated down the Mississippi in large numbers to various cities and there sawed. The lumber produced is included.

This table was compiled by the Northwestern Lumberman. The details may be found in the issues of this paper of January 23, 1897, and January 22, 1898.

[1] The Marine Record, May 13, 1897, p. 9.